SCIENCE

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; JOSEPH LE CONTE, Geology; W. M. DAVIS, Physiography; HENRY F. OSBORN, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; WILLIAM H. WELCH, Pathology; J. MCKEEN CATTELL, Psychology; J. W. POWELL, Anthropology.

FRIDAY, DECEMBER 28, 1900.

CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*PROGRESS IN FORESTRY UNDER STATE CONTROL.**

IN the steps that are now being taken by the State of Michigan looking towards the establishment of a permanent forest policy the recent experience of other States cannot fail to be instructive. In the development of a great public movement in which so much is untried and unforeseen, mistakes are certain to occur, but the chance of their occurrence may be lessened by taking account of the history of similar movements elsewhere. Accordingly, the forestry laws of several States have been reviewed by the writer, and an attempt has also been made, from a comparison of these and a consideration of conditions there existing, to gather such hints as may be available in our own State. It has been thought best to limit this study to the five States, New York, New Jersey, Pennsylvania, Wisconsin and Minnesota, both because they approach Michigan more closely than others in physical conditions and because by far the greatest progress in the development of a forest policy has been made in those States.

The conditions in New England and the Southern Atlantic States are so far different from our own as to be valuable chiefly in a general way rather than in the solution of special problems; the great agricultural

* A review of forestry legislation and conditions in the Central and Northern States, prepared for the Michigan Forestry Commission.

States, Ohio, Indiana and Illinois have nothing to offer in this direction, while the Western prairies and the Pacific slope have their own peculiar and difficult problems, with which we are not immediately concerned. It is with the group of Central and North Central States that our lot is cast by nature, and though behind all of them in our care of the forest, we are nevertheless fortunate in being able to draw on their experience, albeit experience that has not passed the experimental stage.

NEW YORK. EARLY LEGISLATION.

The State of New York has been a pioneer in American forestry. In 1885 a law was enacted by the Legislature providing for the appointment of a forest commission with power to appoint a forest warden, forest inspector, a clerk and other agents. Provision was also made by the same Legislature for a forest preserve consisting of all the lands then owned or thereafter to be acquired in certain counties lying in the Adirondack and Catskill regions "to be forever kept as wild forest lands, not to be sold or leased, or taken by any person or corporation, public or private."

The forest commission was given control and superintendence of the forest preserve, and it was made its duty to maintain and protect the forests on the preserve, to promote as far as practicable the further growth of forests thereon, and in short to have charge of the public interests of the State with regard to forests and tree planting, and especially with reference to forest fires. Supervisors were made *ex-officio* protectors of lands in their townships, the forest commission having power to require, when necessary, that the supervisor appoint one or more forest guards to aid in the control of fire and otherwise.

The commission was also charged with preparing circulars of information and advice for the care of woodlands upon private lands and the starting of new plantations on lands denuded, exhausted, or injured by fire * * * or waste and unfit for other use, * * * these publications to be furnished without cost to any citizen of the State. The commission was unpaid, but the sum of fifteen thousand dollars was appropriated for the purposes of the act.

Considering the early date of this legislation, its comprehensiveness and the extent to which its main features have ever since been retained are alike remarkable. In the first place, the creation and maintenance of a forest preserve as the property of the State but controlled by a forest commission has from that time to this, for a decade and a half, been a central principle. Again, the forest commission, while charged with general responsibility, was expected to appoint officers who should be in immediate charge of actual forestry operations. This feature then embodied in the appointment of forest protectors is still retained in the far more developed system of the present time, in which the commission, not composed of experts, is represented in actual forest administration by the superintendent of forests assisted by other officials and employees. A third feature of the legislation of this early period was the attempt to utilize the services of persons already filling township offices in the enforcement of law, the supervisors, as already stated, being made *ex-officio* protectors of lands in their respective townships.

Subsequent experience, naturally enough, showed the necessity of certain changes even in legislation that embodied so much of permanent value. The provision for the control of forest fires, for example, was inadequate. Making supervisors *ex-officio* fire wardens could not, in the nature of the case, be made operative without strong pressure from a higher authority, and the employment of a commission without compensation, and accordingly without obligation to

devote their entire time to the duties of their office, has given way to the more economical and productive policy of employing and paying men of trained efficiency in the administration of this branch of the public service. In still other particulars it has been found desirable to amend and extend the forestry law of 1885, as will appear in what follows.

Taxation, Sale and Purchase of State Lands.

At an early date the difficult problems connected with taxation, sale and purchase of State lands for forestry were taken up. The laws of 1886 provided that forest lands belonging to the State in the counties of the forest reserve should be taxed at the same rate as other lands, and that the tax should be paid by crediting the sum on the taxes due from each county in which they are located as State taxes.

In 1887 an Act was passed providing for the sale of detached portions of lands belonging to the State or their exchange for lands adjacent to land belonging to the State, and in 1890 the forest commission was authorized to purchase land within the counties including the forest preserve, for purposes of a State park, at a price not to exceed $1.50 per acre. During this time and for a period of several years thereafter the right of the State to much of the land belonging to the forest preserve was contested by parties having real or supposed claims, but the final decision of the highest court of appeal has left the State in possession with a title no longer open to question.

Parks.

In 1887 an Act was passed to establish parks for the propagation of deer and other game upon lands belonging to the State situated in the Catskill region, the forestry commission being authorized to set apart three tracts there for the purpose named, and by an Act of 1892 the Adirondack Park was established within the counties of the forest preserve lying in that part of the State, which it was provided 'should be forever reserved, * * * and cared for as ground open for the free use of all the people for their health or pleasure, and as forest lands necessary to the preservation of the headwaters of the chief rivers of the State and a future timber supply.' In both cases appropriations were made for the provisions of these acts, and the policy of State ownership and control of land for public parks, for sanitary purposes and water supply, and for raising timber as a function of the commonwealth was thus emphasized and confirmed.

Constitution and Duties of the Commission. Changes.

By an Act of 1893 the number of members of the Forest Commission, previously three, was changed to five. The commission was still unpaid, but was now empowered to employ a paid superintendent, two inspectors of forests, a secretary and clerks. Something further was now attempted in the way of fixing responsibility for the control of forest fires. The supervisors, besides being made town protectors of lands and *ex-officio* fire wardens, were required to report fires. But the uncertainty of promptly locating and extinguishing fires by means of untrained helpers, with other inherent difficulties that have been felt until the present time, prevented this system from accomplishing all the good for which it was intended.

In 1895 a change of considerable moment was made, the former commission being superseded by a Fisheries, Game and Forest Commission, consisting of five commissioners appointed by the Governor, their term of office being five years. The duties of the commission were now of far wider scope, and it was, of course, impossible for any member of it to be an expert in all of the various interests committed to its charge. A division of responsibility and

labor, therefore, became at once necessary, and provision was accordingly made for the appointment of an engineer, 35 fish and game protectors and foresters, and various other officers and assistants.

Whatever advantage there may have been in this change as regards the general administration of these various interests, it would seem that at least in regard to what had formerly pertained to the forestry commission there was need of more specific provision for certain duties, and the following year (1896) an amendment was made to the law so as to provide for the appointment of fire wardens, one in each town, and the step thus taken towards the separation of the duties of game protectors from those of fire wardens has recently been carried still farther on the ground that more will be accomplished by this arrangement.

Forest Preserve Board.

Still in the direction of fixing responsibility for the performance of special duties, the law of 1897 provides that the Governor shall appoint three persons from the Forest, Fish and Game Commission and the commissioner of the Land Office as 'the forest-preserve board.' The duty of this board was to acquire for the State lands in the Adirondack Park as they might deem advisable for the interests of the State. Power was given to this board to enter on and take possession of any land, structures and waters in the territory embraced in the Adirondack Park as it might deem advisable for the interests of the State, with authority to adjust claims, and allow cutting of timber, with certain restrictions, by way of compensation; to take means for perfecting the title to lands held by the State, and to vigorously follow up and punish trespass of whatever kind.

For the purposes of this act the expenditure of one million dollars was authorized. In all, the State of New York has now expended about three million dollars in the purchase of land, making the forest preserve board the responsible agency for the purchase, validity of title, and, in short, the entire business connected with the bringing of these lands into the possession and control of the State. An indication of the long and vexatious struggle with claimants to State lands and the determined policy of the State with reference to these lands is seen in the law of 1898, which again gives the forest preserve board full authority for the State to determine the title to lands in the Adirondack Park, or the forest preserve, claimed by persons or corporations adversely to the State.

Forest, Fish and Game Law of 1900.

By this law the forest preserve is definitely limited, as are the Adirondack Park, the St. Lawrence reservation, and, less exactly, the deer parks of the Catskills. The powers of the commission, still composed of five members appointed by the Governor, include all the powers vested in the commissioner of the State land office and the Comptroller, on May 15, 1885, as well as those delegated in succeeding years to the forest commission and the forest preserve board, among which may be specially mentioned purchases in the Adirondack Park, actions for trespass, appointment of fire wardens and provision for instruction and popular information on the subject of forestry.

The office of superintendent of forests is made one of special responsibility, the incumbent being charged with the care and custody of the forest preserve, the prevention of forest fires and the general supervision of the forestry interests of the State. He is required to make an annual report to the commission showing the annual timber product of the Adirondack and Catskill forests, and also the extent of forest fires and losses, * * * with such other reports as

may be necessary for the information of the commission. The duties of fire wardens and the prevention of fires along railroads and elsewhere, are entered into in much detail, and an evident necessity is provided for in requiring the appointment of a chief fire warden to have supervision of the town fire wardens, and by every available means to secure the prevention and the putting out of forest fires.

In reviewing the law of 1900 one is particularly impressed with the fact that it has been found necessary to entrust one man with the direct superintendence of the forest interests of the State, at the same time holding him responsible to a board of commissioners for the intelligent and faithful discharge of the duties of the office, also that for the control of fires one man is again held responsible, the chief fire warden having this as his special and single function. This definite fixing of responsibility can hardly fail to produce more satisfactory results. It is further noticeable that appointments to the commission are still for the term of five years, thus securing a permanent and consistent policy, and that the State now pays for this service as liberally as for other public work. In short, in the State of New York forestry has now become a recognized and permanent branch of the public service. Subsequent experience will doubtless suggest changes in methods of administration, but no interest of the State is more securely entrenched in law or more heartily sustained by public opinion.

School of Forestry. Practical Forestry in the Adirondacks.

New York has been the first State to establish a school of forestry. In 1898 a law was enacted providing for the establishment of a College of Forestry at Ithaca, in connection with Cornell University. Thirty thousand acres of land in the Adirondacks, for which the State paid $165,000 (including buildings), were set apart to be controlled by the university for a period of thirty years, at the end of which time the land is to become again the property of the State as part of the forest preserve. The sum of $10,000 was appropriated for the maintenance of the school, and liberal appropriations, namely, $30,000 for each of the first two years, have since been made for it. The trust was accepted by Cornell University, and Dr. B. E. Fernow, at that time chief of the Forestry Division of the U. S. Agricultural Department, was appointed director of the school. The school was promptly organized, instructors were appointed, and a course of instruction entered upon which has since been extended. Practical forestry operations have been conducted in the college forest since May, 1899, and students of the school are required to spend there a certain part of at least two vacations in the practical study of forestry.

The amount of work that has been accomplished in the college forest in less than a year and a half is surprising and in the highest degree encouraging. A survey of the property has been made, buildings have been erected and remodeled, a nursery has been established in which upwards of a million seedlings have been raised, the planting of a tract of burnt land with young pine and spruce has been completed, important experiments, such as planting in avenues opened in the forest, are in progress, and minute records are carefully kept as a basis for future study and practice. Most interesting of all, however, is the fact that extensive logging (by rail) operations have been begun under forestry principles, to remove the old hard-wood crop and replace it by a more valuable softwood crop in mixture with the hard woods. The thorough utilization of all the wood cut down to the mere brush, for all of which a mar-

ket has been secured, is a novel feature of this logging, besides the care with which all young growth is saved. Moreover, the director expects that no further appropriations will be required, and that the experiment will at once become self-supporting through the profits from the logging operations.

It is too early to form a judgment regarding much of the practical work now in progress. The methods of European forestry are for the most part inapplicable here, and direct experiment becomes therefore the only means of determining the correct treatment of the forests. Mistakes must inevitably occur in a field where all is so new, and it is fortunate for other States that New York has organized such an experiment on so liberal a scale. None the less, it is certainly incumbent on the States with great forest interests of their own to provide for similar experimental study as soon as may be. Conditions vary; a method applicable in the Adirondacks may fail on the sandy tracts of Michigan or Wisconsin, and men must be trained on the ground in direct touch with the peculiar problems and difficulties that each section of the country presents. The New York College of Forestry is now equipped for the training of young men in the principles of forestry and in their practical application in that State, but their training must be supplemented by long-continued study of local conditions, and for this, as a least responsibility, the States interested should provide.

NEW JERSEY.

In New Jersey a considerable body of law has been enacted, especially with regard to forest fires, but without making special provision for its enforcement. As a result of this and of other causes the State has suffered greatly from fires. The coastal plain, where the fires have been most frequent, presents certain points of resemblance to the 'plains' of Michigan, and the extended study of that region which has been made in connection with the State Geological Survey is both instructive and suggestive.*

The 'plains' of New Jersey include approximately 20,000 acres of land lying in the northern extremity of the Atlantic coastal plain which extends from here to southern Florida. These plains are covered with a low bushy growth, much of it consisting of pitch-pine coppice (*Pinus rigida*) mixed with various other species. These plains are reported to have always been treeless, but there is every reason to suppose that this condition is due to repeated fires, since on the surrounding pine barrens may be observed all gradations from a healthy forest to scrubby plains. The soil of the plains, as indicated by chemical analysis, is richer than that of much of the surrounding region where good timber grows. Fire, therefore, is the agency that has rendered large tracts of land, as far as its present state is concerned, unfit for the raising of timber, and is even now converting other land into the same ruined condition. Just what course should be pursued with regard to lands that have already reached this condition is a problem in New Jersey as well as in Michigan. Meantime, the matter of immediate concern is to prevent further extension of such areas.

The means of suppressing these fires are discussed by Dr. Gifford, from whom I have already quoted. His most important suggestion is with regard to the multiplication of fire lanes, which experience has shown to be a successful barrier to ordinary fires. The good-roads movement is very strong in New Jersey, and every good road that is kept properly cleared becomes an effective fire lane. The same is true of railroads

*Gifford, 'Forestal Conditions and Sylvicultural Prospects of the Coastal Plain of New Jersey,' Munich, 1899.

along which combustible materials are kept cleaned up. In addition to this a suggestion with regard to 'forest farms' shows how the southern part of the State might be to a large extent divided up into farms in which the cultivated portion of each would surround a body of timber, which would then be isolated by a wide fire lane from other woodland, thus almost entirely obviating the danger of extensive fires. Suppose a person possesses one hundred acres of woodland out of which he wishes to make a combination forest and farm. The first step is to clear a fire lane around the whole of it, at least two hundred feet in width. This lane should constitute the cultivated portion of the farm. * * * If the hundred acres referred to is perfectly square, a fire lane two hundred feet wide around it would contain about thirty-five acres, as much as one man can comfortably till. There would be left in the center a forest containing about sixty-five acres. * * * If the whole area of woodland in southern Jersey were treated in this way, sixty-five per cent. would be left in wood and the whole would be cut up in such a way that extensive fires would be impossible.* The plan here suggested is apparently as capable of application, in a modified form, in Michigan as in New Jersey.

PENNSYLVANIA.

The history of the forestry movement in Pennsylvania is particularly instructive, since the conditions in that State are in various important particulars similar to, if not identical with, those prevailing in Michigan. Without attempting a complete review of earlier legislation in Pennsylvania, it is desirable to consider in some detail such important features as those pertaining to forest fires and forest reservations.

Early Legislation. Forest Fires.

As early as 1860 the setting on fire of woods or marshes to the loss of any other person was made a misdemeanor punishable by fine and imprisonment, and penalties were also provided for the cutting and removal of timber from the land of another. Failure to fix responsibility, however, made the law a dead letter, and it was followed by disastrous fires and by laxity of public sentiment in regard to them. An attempt was made in 1870 to remedy this by the enactment of a law requiring the commissioners of the several counties of the commonwealth to appoint persons under oath whose duty it should be to ferret out and bring to punishment all persons who either wilfully or otherwise cause the burning of timber lands, and to take means to have such fires extinguished, the expenses to be paid out of the county treasury, the unseated land tax to be first applied to such expenses.

Laws of 1897.

This law, like the former one, remained inoperative, or at least insufficient, until in 1897 it was amended so as to make the commissioners of the several counties responsible to the commissioner of forestry for compliance with its provisions, and prescribing a penalty of fine or imprisonment for failure. The expenses incurred in the employment of detectives were to be borne one-half by the county in which they were employed and one-half by the State. With this definite and not easily evaded responsibility, followed up by most determined and persistent effort on the part of the commissioner of forestry, real progress has been made. Offenders are lodged in jail with as great publicity as possible, and it is safe to say that public sentiment with regard to forest fires has never before in the history of Pennsylvania been formed so rapidly.

The same year, 1897, an act was passed making constables of townships *ex-officio* fire

*Gifford, l. c., p. 45.

wardens for the purpose of extinguishing forest fires, and requiring them to report to the court of their respective counties all violations of "any law now enacted or hereafter to be enacted for the purpose of protecting forests from fire" * * * with penalties for neglect of this duty. As before, the expense of carrying out its provisions was apportioned one-half to the county and one-half to the State, the limit under each act being $500 for any one county.

This legislation is of such recent date and the whole matter is so complicated and of such acknowledged difficulty, that it may well be questioned whether the best method of treatment has yet been attained; certain it is, however, that the present law marks a great advance upon preceding legislation and that its tendency, if enforced for a period of years, will be to more and more restrict both the number and extent of forest fires.

Forest Reservations.

In regard to forest reservations the legislation of 1897 includes two important acts. One of these authorizes the purchase by the commonwealth of unseated lands for the non-payment of taxes, for the purpose of creating a State forest reservation, requiring the commissioner of forestry to examine the location and character of the lands in question, and authorizing him to purchase them for the commonwealth if in his judgment they are available for the forest reservation. The other act provides for a commission of five members to locate three forestry reservations of not less than forty thousand acres each upon waters draining mainly into the Delaware, Susquehanna and Ohio rivers respectively, each of the reservations to be in one continuous area as far as practicable, and at least 50 per cent. of each reservation to have an average altitude of not less than six hundred feet above the level of the sea. The commission is empowered to take by right of eminent domain and condemn the lands as State reservations, the procedure in case of claim for damages being the same as already provided for the taking of land for the opening of roads in the respective counties in which the property is located.

Growth of Timber by Farmers.

A third series of enactments appearing in amended form in 1897 is designed to encourage the growth of timber by farmers. It is provided that in consideration of the public benefit to be derived from the retention of natural forest, the owners of land having on it forest or timber trees of not less than fifty trees to the acre, each measuring at least eight inches in diameter at a height of six feet from the ground, shall be entitled to receive annually during the period that the trees are maintained in sound condition a sum equal to eighty per cent. of all taxes annually assessed and paid upon said land, the eighty per cent. not to exceed 45 cents per acre, provided also that no one property owner shall be entitled to receive this sum on more than fifty acres.

In commenting upon this legislation the Commissioner of Forestry, Dr. J. T. Rothrock, says: "It should be readily perceived that these measures are directly in the interest of the farmer. In the first place, it is a partial removal of tax from land upon which he receives no revenue. In the second place, it is leading up to a lucrative timber crop at a minimum of expense to him, and in the third place, such land, when on a farm, is often on the highest and roughest part, overlooking the cultivated fields, and from its decaying leaves and humus a renewal of fertility is constantly washed down to the lower fields. * * * All of the above laws concern the individual more than the commonwealth. They are to make it possible for him to aid the State

and at the same time to serve himself. Those which follow (with reference to forest reservations) mark a new era in our legislation. They reverse what has hitherto been the established policy of the State and aim at acquisition of timber land instead of sale of it. This change grows out of the now well-established fact that so long as the important watersheds of Pennsylvania are wholly under individual control there is serious danger to the interests of the community, and that, to safeguard these, the State must again possess itself as promptly as possible of these grounds."

With regard to the public sentiment that has made such legislation possible the commissioner adds: "There were grave doubts as to the passage of the bill (authorizing direct purchase of timber lands). But these soon disappeared, and it then for the first time became evident how strong and how general the sentiment in favor of the most active forestry legislation had become. The bill was passed by a large majority. It is clear that the State has at length earnestly entered upon the work of preserving its lumbering industries. The question is no longer whether it shall be done, but how it is to be accomplished. It is noteworthy that all political parties joined in this legislation, and also that the lumbermen, who once looked upon all forestry agitation as an interference with their business, have come to be among the warmest friends of the movement, which is intended to perpetuate, not to limit, their vocation."

WISCONSIN. PRESENT STATUS.

Still nearer to Michigan, both in point of physical conditions and in the extent to which the forestry movement has crystallized into an active call for efficient legislation, is the neighboring State of Wisconsin. Climate and soil conditions are in many respects identical with our own. The northern half of the State has been lumbered extensively, has again and again been visited by destructive fires, and thousands of square miles have been left in what is apparently an utterly hopeless condition as regards agriculture and with a discouraging outlook as regards forest restoration. In a recent paper* the secretary of the State forestry commission has given a concise statement of the situation from which the following is reproduced.

Among the lessons to be learned from the history of the forestry bill of 1899, one of the most important is this, that there is no longer much danger of opposition to the principle that it is the duty of the State to provide for the permanency of forests by appropriate legislation, even to the extent of going into the business of conservative lumbering. Ten years ago such a proposition would have met with not a little hostility and ridicule. It would have been called impracticable, socialistic and un-American. In 1899 not a member of the Legislature, with a single exception, but admitted the desirability of such legislation. Even those who voted against the bill did so avowedly on the ground of expediency for the time being.

Even less opposition than within the Legislature is to be met with among the people of the State. Of course, there is a great deal of indifference and not a little misunderstanding of the aims and objects of forestry reform. In a State situated like Wisconsin, where the question of maintaining a water supply and preventing over-erosion is of subordinate importance, the great body of the people cannot be expected to feel the same direct interest in forest preservation as for instance in southern California, where the existence of agriculture is dependent on the maintenance of the mountain forests. In Wisconsin the

* Brunckeu, 'On the Legislative Outlook for Forestry in Wisconsin.' Read before the American Forestry Association, July, 1900.

class most directly interested is that engaged in forest industries and manufacturing enterprises deriving raw material from the woods. It is very gratifying to the State that as a general rule men of this class are stanch friends of improved forestry, and some of the most energetic promoters of this cause, both in and out of the Legislature, are among the great lumbermen.

Of course, it cannot be expected that entire unanimity should exist as to the best means of reaching the desired end. In particular, the policy of placing considerable areas of forest land under State management is apt to encounter objections from the residents of the counties in which these forests will necessarily be located. They fear, on the one hand, that the reservation of those tracts will hinder the progress of settlement, and on the other hand, they desire to see all land in private hands, so that they may be taxed for the support of local government and improvements. Both these objections are, to be sure, based on imperfect knowledge, and are short-sighted enough. Yet they are made in good faith by men of intelligence, standing and influence. They must be overcome by practical reasoning and the spread of correct information.

Perhaps the most serious problem to be solved in Wisconsin, as well as its neighboring States, is what shall be done with the immense areas of denuded timber lands which are now growing up into vast wildernesses of worthless scrub, subject to the ravages of fire, and a constant menace to the standing timber adjoining. There are no physical obstacles to the reforestation of these tracts. But the financial and political difficulties are enormous. Most of these lands are the property of the lumber companies which harvested the timber. Not a little of it, however, has been sold for taxes and bid in by the counties. These do not know what to do with those lands, and from time to time sell them to speculators at nominal prices, sometimes for less than a dollar forty cents. Now there can be no question that much of the land of this kind is fairly good agricultural land, although it cannot be compared in quality with the hard-wood lands where the timber is still standing. But the greater portion is barren sand just good enough to bear a fair crop of pine, but unfit for agricultural crops after the slight accumulation of humus is exhausted. To persuade ignorant settlers to locate on such lands and to try to make them into farms is little short of a crime.

The great mass of the people of northern Wisconsin are well-meaning, upright folk, and they know well enough that much of this land is unfit for settlement. But it is not possible to draw a hard and fast line between the fit and unfit land, and the temptation is great to find invariably that the really unfit land is just beyond the boundaries of the next township. So the settlers continue to take up these sand barrens, with disastrous results to themselves and no permanent benefit to the community. The only feasible way to put these lands to the use for which they are adapted, and by which they can ultimately yield a profit, would be to place them in the hands of the State for rational forest management.

A number of owners of large tracts of land of this class have expressed their willingness to cede their holdings, which are practically valueless to them, to the State, if it will take proper care of them. It is probable that the solution of the problem will be approached from this direction. But in order to make this possible, some legislation will be needed, and for that purpose the friends of forestry in Wisconsin look forward to the meeting of the Legislature during the coming winter. There is the best possible reason to believe that a

bill for the establishment of a rational forestry system will be passed by the next Legislature. It will be devised substantially on the lines laid out in the bill that failed of passage at the last session, with certain modifications, required by the rise of a new factor since the Legislature adjourned. The State University of Wisconsin has now under consideration a plan for the establishment of a forestry school as nearly as possible on the model set by the schools at Cornell and Yale. For this purpose the express authority and aid of the Legislature will probably be sought, and it is obviously proper to bring the State forest department and the State forestry college into as close relations as the difference between administrative and educational functions will permit.

MINNESOTA. FIRE WARDENS.

Minnesota has made very substantial progress in forestry legislation, especially in the direction of controlling forest fires. A most commendable feature of the law which has been in operation for five years, is the definite fixing of responsibility by the appointment of a chief fire warden who has general charge of the fire warden force of the State, and who is authorized during the dangerous season to use such means as he sees fit to prevent or suppress fires, the sum of $5,000 being available for this purpose. Supervisors of towns, mayors of cities and presidents of village councils are constituted fire wardens, with authority to arrest without warrant any person setting fire to woods or prairies to the danger of property, the wardens themselves being liable to penalties for neglecting the duties of their office. Under the vigorous administration of the present chief fire warden, much has been done to promote the growth of a correct public sentiment and not a little has been accomplished in the actual prevention and suppression of fires. Warning notices in great number have been posted and the intelligent cooperation of a large force of assistant wardens has been secured. During the drought in the early summer of the present year, over 300 fire wardens were in correspondence with their chief, reporting precautions taken, and otherwise showing their interest and activity. The system is doubtless capable of improvement, but in its inception and reasonably successful working a great step has been taken, and by so much Minnesota is well in advance of Michigan and Wisconsin.

Forest Reserves. State Forestry Board.

By the Legislature of 1899 an Act was passed designating as Forest Reserves lands set apart by the Legislature for forestry purposes, or granted to the State by the United States Government, or by individuals for such purposes, and creating a State Forestry Board to have the care and management of the forest reserves and to represent the State in all matters pertaining to forestry.

The constitution of the board has evidently been arranged with a view to making it non-political and as efficient as possible. It consists of nine members, including the chief fire warden, *ex officio*, the professor of horticulture in the State University, three persons recommended by the regents of the University on account of qualifications that are specified, and four to be recommended by the following bodies, namely: The Minnesota State Forestry Association, The Minnesota State Agricultural Society, The Minnesota Horticultural Society and the State Fish and Game Commission.

In creating such a board, authorized to accept lands for forestry purposes and to conduct forestry operations in the name of the State, including the sale of forest products, Minnesota has fully recognized forestry—not only from the protective, but

also from the commercial point of view—as a proper function of the State. It is safe to say that this advanced position has the practically unanimous approval of the men in this country, few in number, to be sure, who are entitled to rank as forestry experts, and of other thoughtful students of the problems connected with this subject.

CONCLUSIONS.

From the foregoing review a number of suggestions may be drawn in regard to forestry problems in Michigan.

1. Necessity of legislation and State control.—There is no way in which satisfactory progress can be made until the State assumes responsibility. New York, Pennsylvania, and Minnesota have fully recognized this responsibility, and in each of them an efficient forestry service is maintained by the State. It should be noted that, especially in New York, where this service has been most developed, this fulfillment of its duty by the State, even at considerable expense, has the practically unanimous approval of its citizens. The opposition of selfish and irresponsible parties has been overcome and the State is to-day in peaceable possession of great forest areas of inestimable value, not merely for their timber, but as conservators of a pure water supply. The principle, therefore, has been fully established in this country as well as in the Old World that the protection and development of its forest for the benefit of its citizens, present and future, is a proper function and obligation of the State.

2. Form which legislation should take.—From the experience of other States, it would seem that one of the first steps to be taken would be the location, under the advice of competent experts, of such tracts of land as are better suited for forestry than for agricultural purposes, followed by proper measures for the acquisition of so much of these lands as may be deemed advisable. As large areas are already abandoned and have practically come into the possession of the State, the procedure, in many cases, would consist mainly in securing a valid and permanent title. The State of New York, as already pointed out, has a forest preserve board of three members specifically charged with the duty of acquiring lands for the State, with authority to take possession of lands, to adjust claims, and to take measures for perfecting the title of lands held by the State. In Pennsylvania a commission of five members has substantially the same duties, which are also shared by the Commissioner of Forestry. In this matter there is probably nothing better for Michigan than to follow in a general way the method adopted by these two States.

The control of forest fires presents one of the most difficult subjects with which Legislatures and forestry commissions have had to deal. In New York and Minnesota the appointment of a chief fire warden, who is paid for his services and is held responsible, marks a distinct advance, and the policy of Pennsylvania, of imposing and inflicting severe penalties for the setting of forest fires, has thus far been followed by good results. In any case the essential thing is the fixing of responsibility and provision for the execution of laws relating to fires. The first can only be attained by the appointment of responsible persons, and the second by paying for service rendered. None of the three States in which this has been done is likely to abandon this advanced policy for the more expensive one of allowing fires to sweep unchecked over its territory.

Thieves in some quarters of the State are worse than fires. An efficient trespass agent with adequate authority is the proper agency for holding the nuisance in check until it can be more radically dealt with. The repeal of the homestead law, earnestly

advocated by those who have carefully studied the question, is apparently a necessary step in the suppression of this evil.

3. The utilization of educational institutions in the development of a rational system of forestry.—In this, again, New York is well in advance, although Connecticut has followed in the establishment of a school of forestry at its leading university, and in calling in the services of a trained forester whose work will be carried on in connection with the State experiment station. There can be no doubt that institutions of learning, endowed by public funds, owe to the State the best that they can contribute towards the solution of such problems of public interest, nor is there any doubt that these institutions, permanent in their nature and to a great degree free from political influences, are the best fitted to fulfill a duty in which a consistent policy and continuity of action are indispensable. Both the University and the Agricultural College of Michigan have recognized this duty and have cooperated in rendering such service as they have found practicable. There is still every reason for the continuance of this cooperation and for the enlargement of plans for further work. Should we follow in this the lead of Connecticut, which is similarly situated in the separation of the institutions directly concerned, there would fall to the University the establishment of a department of forestry devoted largely to investigation, while upon the Agricultural College would naturally devolve the care and further development of its experimental forestry stations. Should either or both institutions come into possession of extensive tracts of cut-over lands, with which it has been proposed to entrust them, these new possessions would furnish a series of problems the solution of which is quite as likely to prove of financial value to the State as to themselves. Profits must necessarily be relatively remote, but it is a matter of encouragement that the director of the New York School of Forestry, with but 30,000 acres of land on which to operate and the work barely under way, is confident that hereafter the forestry operations of which he has charge will be self-supporting, and it is the judgment of experienced lumbermen, as well as of scientific foresters, that in Michigan the conditions are such as to insure to the State, or to institutions that can afford to wait, a substantial profit from practical forestry.

V. M. SPALDING.
UNIVERSITY OF MICHIGAN.

GEOLOGY AND GEOGRAPHY AT THE AMERICAN ASSOCIATION.

THE joint session of Section E of the American Association and the American Geological Society was opened on Monday, June 25th, in Schermerhorn Hall, Columbia University, to listen to the address of Vice-President Kemp, of Section E, on the 'Precambrian Sediments in the Adirondack Mountains.' This address, which has already been published in full in SCIENCE, July 20, 1900, was an exceedingly valuable and lucid contribution to the geology of this complicated but interesting region.

The first paper before the regular session of Tuesday morning was also one by Professor J. F. KEMP on the 'Local Geology about the City of New York,' which during the past several years has been studied in considerable detail by Dr. F. J. H. Merrill and others. This paper was given at the request of the 'sectional committee' and was preliminary to the three geological excursions arranged for and participated in by the members of Section E and of the Geological Society on the three following afternoons.

The second paper of the Tuesday morning session was by Mr. E. O. HOVEY, on the 'Geological and Paleontological Collections in the American Museum of Natural His-

tory,'* this paper having been prepared and presented at the request of the sectional committee preliminary to the visit of the members of Section E and of the Association at large to the American Museum on Tuesday evening.

Mr. F. H. Newell, in his paper on 'Hydrographic Surveys in New York,' described the objects and methods of this work as now carried on by the United States Geological Survey. One of the primary reasons urged for preserving the forests is the beneficial influence which they have upon the flow of the streams. The belief is widespread that the forest-cover conserves the waters, prevents floods, to a certain extent, and tends to increase summer flow, and that the cutting off of the forests has resulted in an increase of spring floods and in diminished flow during the summer droughts. All admit these influences, yet it has been extremely difficult to define the degree to which they are operative and to obtain convincing data for the support of conclusions.

It is important to know within reasonable limits to what extent the forests and other conditions influence the flow of streams; and the Division of Hydrography of the United States Geological Survey, cooperating with the Division of Forestry of the Department of Agriculture, is endeavoring to bring together facts upon which an answer to this important question can be based. The first step is to learn of the fluctuations of various rivers in different parts of the United States, to ascertain their regimen and to compare this with the cultural conditions of their drainage areas. To obtain these facts it is necessary that careful examinations be carried on through several years, so as to include periods of drought as well as those of excessive precipitation. For this purpose typical streams in various parts of the United States have been selected and stations have been established, at which the flow of the rivers is systematically measured. These river stations in many States, both east and west, cover almost every range of climatic condition from humid to arid. In the State of New York about 20 river stations are now being maintained, most of these being located on streams coming from the Adirondacks to form the upper Hudson, the Mohawk or the Black River. Cooperation in this work is maintained with the State Engineer and Surveyor, and also with the Forest, Fish and Game Commission recently appointed.

Diagrams showing the fluctuations of the streams from day to day throughout the year are prepared from the results of measurements, enabling a person to comprehend at a glance the great variation in volume of the streams under natural conditions. Knowing the changes which follow causes beyond the control of man, it should be possible to ascertain the relative importance of the fluctuations which result from artificial or controllable causes. It may require observations extending over a considerable length of time before we can definitely discriminate between effects produced by changes in the forest conditions; but however long the time or great the expense, it is of the first importance to ascertain these facts.

Mr. W J McGee's paper on the 'Occurrence of the Pensauken (?) Formation' within the limits of the city of Washington, brought out the following salient features: The commonly recognized geologic series in Washington and vicinity comprises, in descending order, (1) Later (low level, or fluvial) Columbia; (2) Earlier (high level, or interfluvial) Columbia; (3) Lafayette; (4) Chesapeake; (5) Pamunkey; and (6) Potomac. In a few localities, especially in the deep cutting in the 200-foot terrace at the head of Six-

* Published in Science.

teenth Street, deposits have been observed which fail to fit into this series. This cutting reveals, unconformably beneath the Earlier Columbia and uncomformably above the Potomac, a heavy deposit of loam and gravel of a structure, composition, texture and material simulating the Earlier Columbia formation in its normal aspect, save that the materials are more extensively disintegrated and decomposed. The resemblance of the deposit to the Earlier Columbia is such that it might readily be classed with that formation if found isolated; but in the Sixteenth Street exposure the two deposits are juxtaposed and separated by a well-defined unconformity—*i. e.*, the stratigraphy shows that the deposit in question is materially older than the earlier Columbia. On comparing the deposit with the Lafayette, as displayed in the nearest exposures of that formation on the west, north and east, it is found to be so different in materials and structure as to demand separation on lithologic grounds; moreover, the deposit is confined to a depression, or amphitheater, which did not exist at the time of Lafayette deposition, but was produced during the period of rapid degradation accompanying the post-Lafayette uplift; so that it must be discriminated from the Lafayette on the basis of homogeny as well as on that of lithology. The interpretation of the deposit is simple: it is evidently a record of an oscillation during the post-Lafayette and pre-Columbia time, which was not of such amplitude and length as to inscribe itself deeply in the local series of formations and land forms. On seeking to correlate the deposit with other elements in the coastal-plain series, difficulty is encountered; no corresponding deposits are known either southward or eastward in Virginia and Maryland; the nearest known deposits of corresponding character and position are a part of those found in southern New Jersey and first grouped by Salisbury under the designation Pensauken, but afterwards divided.

In Dr. JOHN M. CLARKE'S paper on the 'Lenticular Deposits of the Oriskany Formation in New York,' this formation was described as attaining in eastern New York its greatest thickness south of Albany county, where it is highly calcareous and carries its normal fauna. In its extension through central and western New York its deposits are wholly arenaceous and siliceous and they alternately thin and thicken, thus forming a series of lenticular beds which are connected by thin sheets or wholly severed by the actual disappearance of the formation from the rock series. Beginning in Albany county, the formation has a thickness of but one or two feet, thence westward of Schoharie county it slightly thickens, and again thins and actually disappears in southern Herkimer county. Still farther westward at Oriskany Falls, the typical section, it attains a thickness of some 20 feet. At Manlius, Onondaga county, it has decreased to about one foot, and at Jamesville, five miles west, increases to three feet six inches. Four miles west of here, at Brighton, its thickness is one foot six inches, whence westward, at Elmwood, one mile and a half away, it thins to six inches. Again the formation disappears from the rock series, the eastern thinning edge of the next lens appearing first at Split Rock, near Syracuse, thickening towards Marcellus Falls, five miles away, and at Skaneateles Falls, six miles further west, attaining a cross-section of 18 feet; thence suddenly dropping to ten inches at Auburn, six miles still further west. This lenticular mass, designated the *Skaneateles lens*, appears to be the largest of these lenticular deposits west of Albany. From this point westward but two inconsiderable lenses are observable, the deposits being a thin sheet seldom over more than a few inches across.

This evidence is regarded as indicative

of an actual shore line during Oriskany time. No Helderbergian deposits occur in this western section of the State. The transgression of the Oriskany here is in conformity with similar evidence in other regions, of its wide extent beyond the limits of the preceding Helderbergian formation.

A second paper by Dr. J. M. Clarke, on 'The Fauna of the Arenaceous Lower Devonian of Aroostook County, Maine,' brought out the fact that a careful re-study of this fauna indicates that its proposed construction as a Silurian fauna correlating with the Tilestones of Murchison's Silurian section is not justified by the character and affiliation of its species. With such New York Oriskany species as *Anoplia nucleata*, *Cyrtina varia*, etc., it contains a number of species identical with those of Lower Devonian faunas of Western Europe. The faunas of the two localities of the Chapman Plantation, Edmund's Hill and Presque Isle Creek, have very little in common, but both show a close alliance with the arenaceous Lower Devonian faunas.

A paper on 'The Great Chisos Rift along the Canyons of the Rio Grande River,' by Professor R. T. Hill, and embodying the results of a trip by him through the lower portion of this canyon late in 1899, was one of unusual interest, as the region described was entirely new to the scientific world and one which proved to be varied and beautiful in scenery, and rich in geologic and topographic problems. The paper was illustrated by a considerable number of lantern slides prepared from photographs taken by Professor Hill during his journey.

In a short paper, 'Notes on the Geology of Central South Carolina,' Dr. D. S. Martin described the work about Columbia now being carried on by himself and Dr. L. C. Glenn, and the success of the latter in discovering eocene and cretaceous beds separating the 'Potomac' and 'Lafayette' deposits, which in many of the new railway cuts about Columbia are lithologically indistinguishable.

Dr. Alexis A. Julien read a paper on 'The Genesis of the Pegmatite in North Carolina,' in which he called attention to the constant association of vein and of dike phenomena, hitherto without satisfactory explanation in the pegmatite occurrences in the schists of that State and along the Appalachian belt. The several genetic hypotheses were reviewed, based on intrusion of fused magma, vein-infiltration, segregation and pneumatolytic introduction of igneo-aqueous magma. But none of these accounted for important facts observed, *e. g.*, vast pegmatite masses connected with almost capillary fissures, frequent distinct relationship of the material of the pegmatite and adjoining schists, and the almost universal banded structure and evidences of mineral concentration within the pegmatite. In their place he proposed the hypothesis of metasomatic aggregation, by molecular rearrangement of the entire material of portions of the schists in vicinity of fissures, through the action of mineralizers; lateral segregation within the igneo-aqueous magma or emulsion so formed, with production of vein-structure, etc.; crushing and even shearing, by orogenic movements, translation along the fissure-plane, partial obliteration of vein-structure and development of facies of a dike. On such an occurrence of pegmatite, therefore, one looks upon the birth of granite *in loco*, in at least one mode, rather than upon an intrusion of foreign material into cavities of discission or dissolution.

'The Geological Features of the Menominee Iron District of Michigan' were described in a short paper by W. S. Bailey, as occupying an area of about 120 square miles on the north side of the Menominee river, from Waucedah westward to a short distance beyond Iron Mountain. The ore-producing rock constitutes a trough be-

tween rims of basic volcanic rock on the south and granites and gneisses on the north. These are regarded as Archean in age. Between these rims lie two series of Huronian sediments separated by an unconformity. The lower Huronian sediments comprise in ascending order quartzites, dolomites and jasper. The upper Huronian beds are a jasper and ore formation, black slates, a second ore formation and gray slates. Over these unconformably lie horizontal beds of Lake Superior sandstone.

The ore formations consist of alternating beds of jasper, hematite and quartzites. The principal producing horizons are in the upper Huronian. The lower ore-bearing beds are mainly fragmental, and the upper ore-bearing beds are mainly altered crystalline sediments. The ore of the latter has come from iron carbonates, which have been decomposed as in the Marquette district, yielding cherts and hematite.

All of the Huronian rocks are strongly compressed and closely folded. The ores occur in pitching synclines with impervious bottoms. Geologically the Menominee district bears a striking resemblance to the Marquette district. The lower Huronian ore measures, however, which are large producers in the latter district, are scarcely known in the Menominee district, in which district the principal producing mines are in the lower ore formation of the upper Huronian.

In a paper on 'The Still Rivers of Western Connecticut,' Professor WM. H. HOBBS described the general course of the streams of this region as being to the south-southeast down the slope of the Cretaceous plain of erosion. In a few cases, however, large tributary streams are found flowing in nearly the opposite direction. Two notable instances of this sort have been studied, each bearing the name 'Still River'; and attention is thus directed to their exceptionally sluggish currents, due to the barely perceptible slope of their present beds. One of these streams rises near Tarrington, flows north-northeasterly past Winsted, and, after a course of about twelve miles, enters a branch of the Farmington at Robertsville. The other river of the same name, some twenty-five miles distant to the southwest, is a tributary of the Housatonic, having its source in a barrier of drift hills south of Bethel, flowing north northeasterly past Danbury and Brookfield, to enter its trunk stream just where the latter departs from the limestone valley to cut its way through gneiss.

In each case the course of the Still River has been determined by a belt of limestone within harder walls of gneiss and schist. The Still River, tributary to the Farmington, is, furthermore, an instance of reversal of drainage brought about by obstructions of glacial material.

In a paper on 'Drift Erosion, Transportation and Deposition,' by Mr. WARREN UPHAM, the work of the North American ice-sheet is described as threefold. Its erosion of the bed rocks, over the greater part of the glaciated area, is shown to have supplied far more drift than was desired from the preglacial residuary clay and river sand and gravel. Only near the borders of the ice-sheet, or to a distance of two or three hundred miles from it in the interior of this continent, the successive stages of fluctuating glaciation added each its drift deposits without general erosion of the underlying rocks or the earlier formed drift. The transportation of the drift appears to have been chiefly within the lower part of the ice-sheet, reaching in considerable amount at least 1,000 feet above the land surface on the mainly plain-like region of Minnesota and Manitoba. Its deposition for the greater part was directly from the ice, yielding the till and a large proportion of the mass of the moraines. Another

large class of the drift formations shows modification by the waters of the melting ice surface and of rains, and is, therefore, called modified drift. These several phases of action and resulting deposits of the ice-sheet are discussed in the full paper, with illustrations from field observations, and from comparison with now existing glaciers and ice-sheets.

Professor C. W. Hall, in a paper on 'The Chengwatona Series of the Keweenawan' formation, describes this interesting series of volcanic rocks, first identified by Chamberlin as belonging to the Lake Superior copper-bearing formation. These rocks are exposed along the Snake River almost continuously for two miles, with edges 3 to 20 feet above the stream. The succession consists of basic eruptions (lava flows of typical structure) with intercalated conglomerates. The bottom of each flow is of very fine texture and in places apparently devitrified; the middle portion is of coarser yet quite uniform texture, while the top is strongly amygdaloidal with frequent tuffaceous phases. The recognition of the different phases of each flow and the transition from one flow to another can be distinctly seen, as the division planes are sharply drawn. In two or three instances the overlying tuff is thicker than the compact portion of the flow. The diabase is, for the most part, of the characteristic ophitic type, exposed surfaces first mottling and then becoming pitted through unequal decomposition. The amygdaloid carries the minerals characteristic of the Lake Superior basic eruptives with laumonite or some relative the predominant one. Lying interbedded with these diabase flows is a series of conglomerate beds; five were counted. They vary in thickness from 5 feet to 104 feet, and represent a total of more than 200 feet. Pebbles of gabbro, diabase, diabase porphyry, augite syenite and granite conglomerate are recognized, thus suggesting an age even later than tha of the augite syenite around Duluth, in other words, high up in the Keweenawan formation. The number of successive lava flows in the Chengwatona series is its most remarkable feature; not less than 45 were counted, and neither the top nor bottom flow was seen. The total thickness cannot be less than 10,000 feet actually in sight. The attitude of the entire series is uniform, and there is no sign throughout of sufficient displacement to duplicate a single flow. Besides, the conglomerate beds are so unlike in thickness that they cannot by error well be duplicated in the above estimate.

In a paper on 'A Simple Modeling Machine,' Dr. E. B. Mathews described a simple machine, designed by himself, of which many geologists and geographers have long felt a need.

The expense and great amount of time required to make simple relief models of areas studied by the existing methods have prevented geologists from making use of models in the representation of tentative geological interpretations. Moreover, the models made by cross sections, pegs or layer methods take much time and involve a high degree of personal equation in the sculpture. The machine described is a mechanical device for representing with considerable accuracy the territory included within a topographic atlas sheet. Two features are regarded of special importance: in such a machine, there must be rigidity in the horizontal plane in order to avoid distortion, and even greater rigidity in the vertical plane to eliminate vertical exaggeration. It was found possible to obtain the first by the use of a rigid pantograph in which the arms were about an inch and a half broad and three-eighths of an inch thick. The vertical accuracy is obtained by a stylus passing through the end of one arm of the pantograph and held at the desired height by two set screws, the whole resting on a

free-moving support, and this in turn resting on two wooden knife edges. The pantograph is fixed to the top of a table from which a portion of the top has been removed. Below this opening is a depressed shelf on which is placed a tin box containing the plastic clay, which is of a thickness corresponding to the uniform base and the highest point to be represented. Beginning at the topmost contour the stylus traces the limits of that elevation. Outside of the line traced the clay may be removed to the first bench. In the same way all the contours may be followed by one arm of the pantograph and traced in clay by the other. The result is a rough representation of the shape of the county in which the surface is composed of a series of steps. These may be removed by a modeling wire and the whole given artistic life without changing the relative elevation of the different parts. It has been found possible to prepare this first relief model of a quadrangle in a day's time. From this it is possible to make the usual plaster matrices and thence the plaster relief according to the usual methods. The advantage of the machine lies in the speed by which the models may be produced and the elimination of the personal equation in the drawing of the heights.

In a short but interesting paper on 'Certain Late Pleistocene Loams in New Jersey and Adjacent States,' Professor R. D. SALISBURY presented the results of his numerous observations concerning the origin of certain recent loams found widely distributed in that region. These had been examined in hundreds of localities and found to be generally more or less local in character. Sections were exhibited showing its mode of occurrence near Jamesburg, Princeton, Trenton, Philadelphia, etc. The conclusions arrived at from these various examinations were that these loams are of marine origin and represent deposits made during a recent short period of submergence, which submergence in southeastern New Jersey extended to a depth of not less than 200 feet. The work of Professor Salisbury is the more interesting as it has an important bearing on the results of the study of somewhat similar surface loams and sands further south by Hilgard, McGee, Smith and Holmes.

In the paper on 'The Principles of Paleontologic Correlation' by Professor JAMES PERRIN SMITH, paleontologic correlation was described as being of two kinds: (1) Direct, where the faunal regions were closely connected and intermigration of species was easy. An example of this is the correlation of the Cretaceous of the Atlantic and Gulf regions with that of Europe; (2) Indirect, where the faunal regions were separated by land barriers. An example of this is the correlation of the Cretaceous of the west coast with that of the interior and Atlantic regions. These were separated by impassable barriers, but the Atlantic Cretaceous was connected with the European, the European with the Indian, and the Indian closely related to that of the west coast.

Oppel attempted to divide stratigraphic formations into faunal 'zones,' of which he made 30 in the Jura alone, most of which cannot be recognized in outside regions. Buckman divided the Jura into *hemeræ*, of which he found 26 in the Lias alone. These, too, can not be recognized away from the province where they were founded. But, occasionally, the fauna of a certain horizon can be identified in very remote regions, this extension corresponding to periods of unrest, of oscillations of the land and opening up of connections between regions that before were separated. The writer proposes to confine the term *zone* to such widely distributed faunas, which thus become important criteria in interregional correlation. Such zones are that of *Manticoceras intermerceras* in the upper Devonian, of *Agamides rotatorius* in the Kinderhook,

of *Gastrioceras listeri* in the middle coal measures, etc.

The principles governing the migration of marine invertebrates were discussed, and the reality of 'colonies' affirmed. Homotaxis, as defined by Huxley, was discussed, and it was shown that even now similar faunas are living synchronously in widely separated regions, and that the same could have happened, and probably did, in past time. Therefore, correlation is often real, and not merely homotaxial. The strata coming between the interregional zones are, in a sense, only homotaxial, but the zonal faunas themselves often represent synchronous appearances of immigrants in two or more regions from a third unknown point of origin. The substantial agreement of the stratigraphic column in all the continents is the best possible proof of the reality of correlation, for the discrepancies that occur in the periods of endemic development are all corrected in the periods of readjustment, and nature's periodic trial balances bring into harmony the record in the interregional time scale.

The following additional papers were presented before the Section, all except the first two being under the auspices of the Geological Society:

The Ice Age in New Zealand: C. H. Hitchcock. (With lantern slides.)

On a New or hitherto Unrecognized Horizon in the Lower Portion of the Devonian System in Eastern Canada: Henry M. Ami.

Native Copper from Garfield County, Oklahoma: Erasmus Haworth.

Petrographic Studies on the Andesitic Rocks of Silverton, Colorado, with Analyses by W. G. Haldane and E. W. Gebhardt: Frank R. Van Horn.

The Hudson River Beds of the Vicinity of Albany, and their Taxonomic Equivalents: Rudolf Ruedemann. (Introduced by J. M. Clarke.)

Giants' Kettles Eroded by Moulin Torrents: Warren Upham.

Pleistocene Ice and River Erosion in the St. Croix Valley of Minnesota and Wisconsin: Warren Upham.

Evidences of Interglacial Deposits in the Connecticut Valley: Charles H. Hitchcock.

Volcanic Phenomena on Hawaii: Charles H. Hitchcock.

A Theory of the Origin of Systems of nearly Vertical Faults, with Application to the Newark Basin of the Pomperaug River: W. H. Hobbs.

EXCURSIONS.

The following excursions were arranged for and participated in by the members of Section E and of the Geological Society:

Tuesday afternoon.—Under the leadership of Professor Kemp, the crystalline rocks in that portion of New York City east and north of the Columbia University buildings were visited and carefully examined. The interbedded arrangement of the limestones and gneisses indicated clearly the sedimentary origin of these materials.

Wednesday afternoon.—Under the leadership of Professor Kemp, the grounds in the Botanical and Zoological Gardens were visited, and careful attention on the part of the members was given both to the character of the crystalline rocks and to the later surface phenomena, including potholes, the glacial deposits and the new and old Bronx River channels.

Thursday afternoon.—Under the leadership of Dr. A. A. Julien, a visit was made to the Palisades along the west bank of the Hudson for the purpose of studying the geologic and topographic relations there, and for the further purpose of seeing the extent to which the Palisades were being injured by the extensive quarrying now in operation for the purpose of securing road metal.

J. A. Holmes,
Secretary of the Section.

THE NEW CHEMICAL LABORATORY OF THE UNIVERSITY OF KANSAS.

As a new laboratory has been constructed during the past year at Lawrence, to accommodate the departments of chemistry and pharmacy, some facts in regard to the building, and the appliances furnished, may be of value to others who contemplate erecting buildings for this purpose.

The material used, as shown in the cut, is native limestone, laid in horizontal courses with recessed pointing. A large portion of this was quarried on the site, as the upper courses of rock were removed in order to obtain a solid foundation on the lowest of a series of ledges. Some of the courses in the excavation were of light stone, while others were colored yellowish by iron oxid; the light rocks are used for the outside layers, except on the back side, and the yellow rocks for interior filling. For trimmings, a limestone, known as Jefferson County, which occurs in ledges something over a foot in thickness, within a few miles of the city, is utilized.

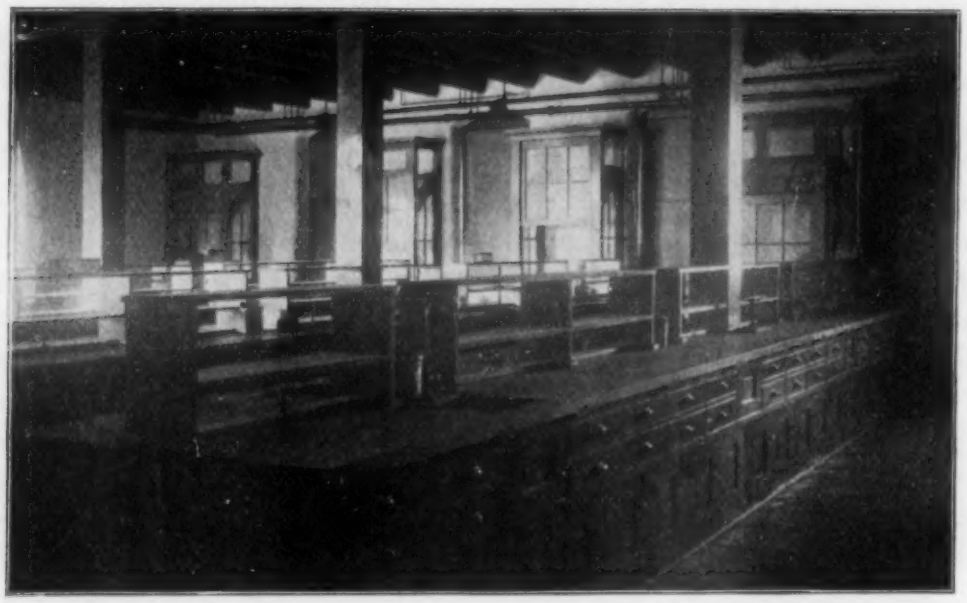
The plans were drawn by J. G. Haskell, architect, and the director of the laboratory with the assistance of his colleagues, after personal inspection and study of many of the largest and best appointed chemical laboratories in the country. The building is plain and massive in construction, and while very little was expended for adornment, no expense was spared to secure the best practical conditions for chemical and pharmaceutical work, according to modern methods.

The length of the building is 187 feet and the greatest breadth 70 feet, with a central portion devoted to offices, private laboratories, etc., and two wings for larger laboratories and lecture rooms. Below the basement floor there is a plenum four feet in depth, and as the building is upon the side of the hill, three sides of the basement are above the ground, and well lighted. Each of the three other stories is twelve feet in height, and the attic is commodious and well lighted.

Chemical Laboratories. South Front.

As the so-called mill construction is used

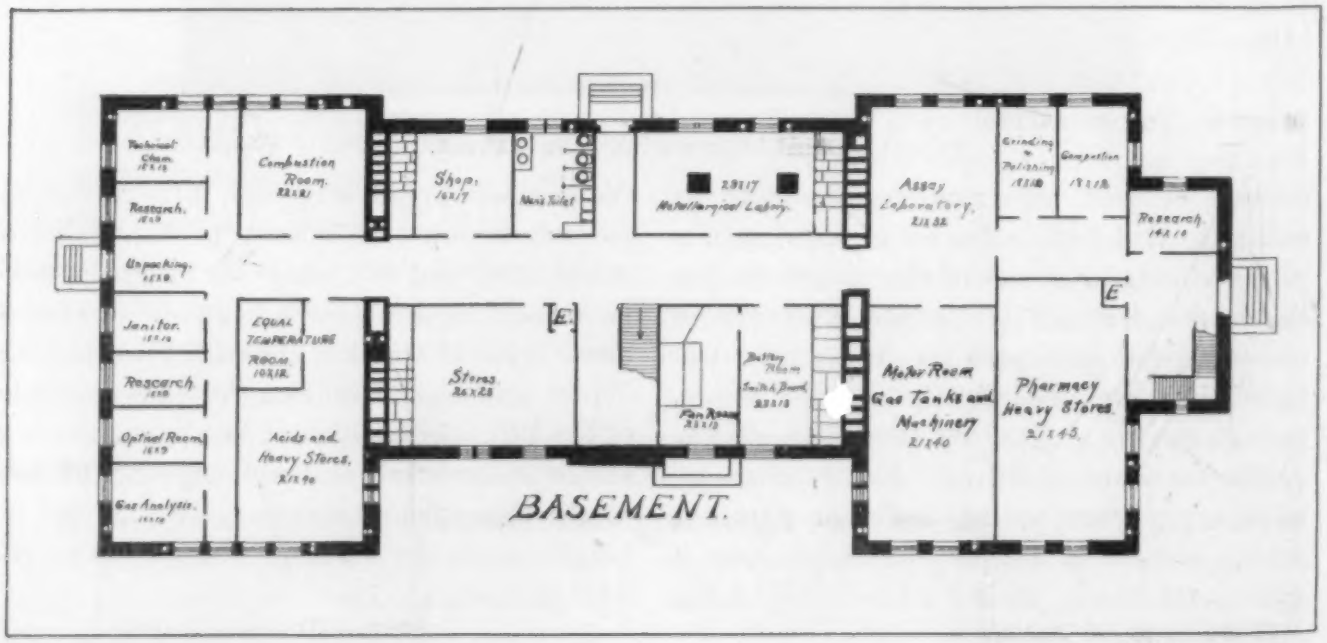
throughout the building, the joists and ceilings are finished with shellac and hard oil, and the double floors, which are made of one

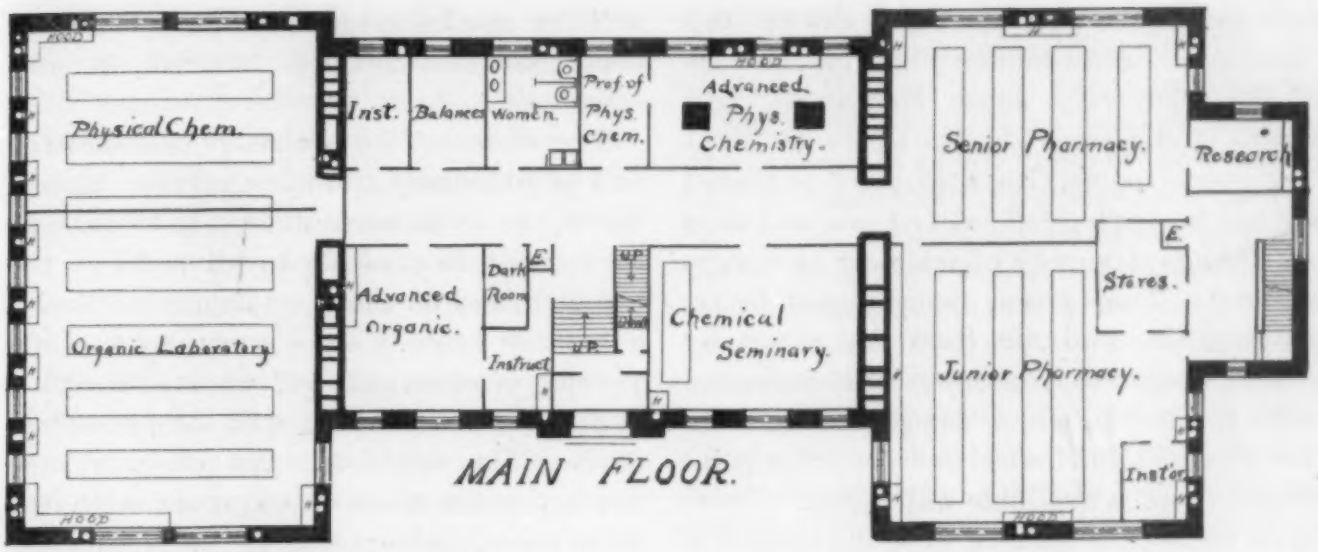


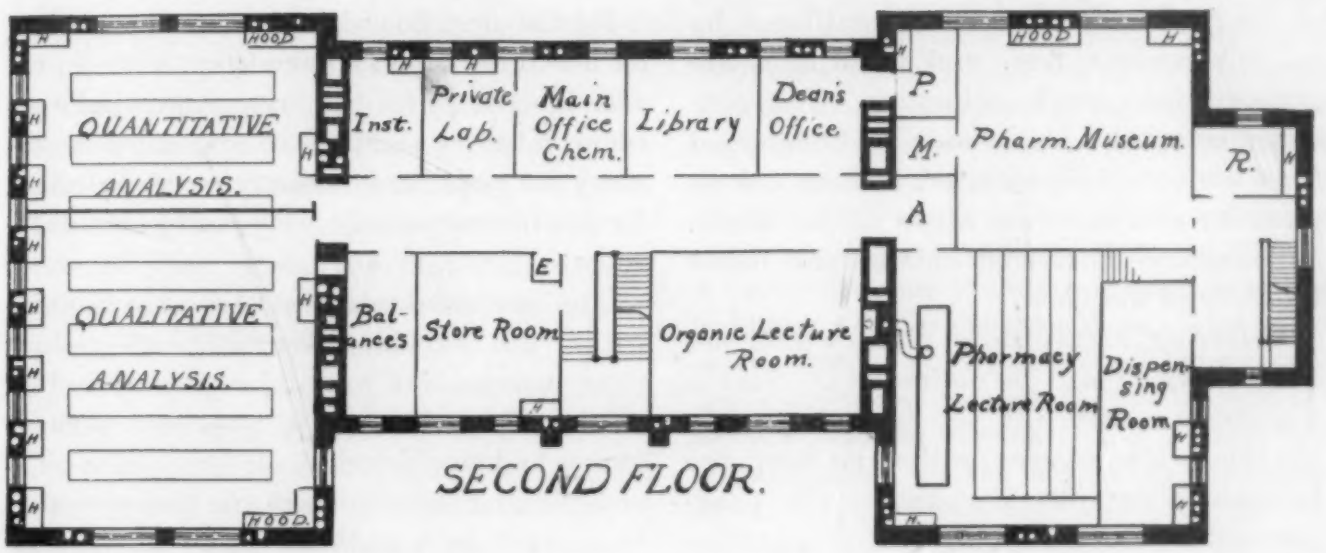
In the Qualitative Laboratory.

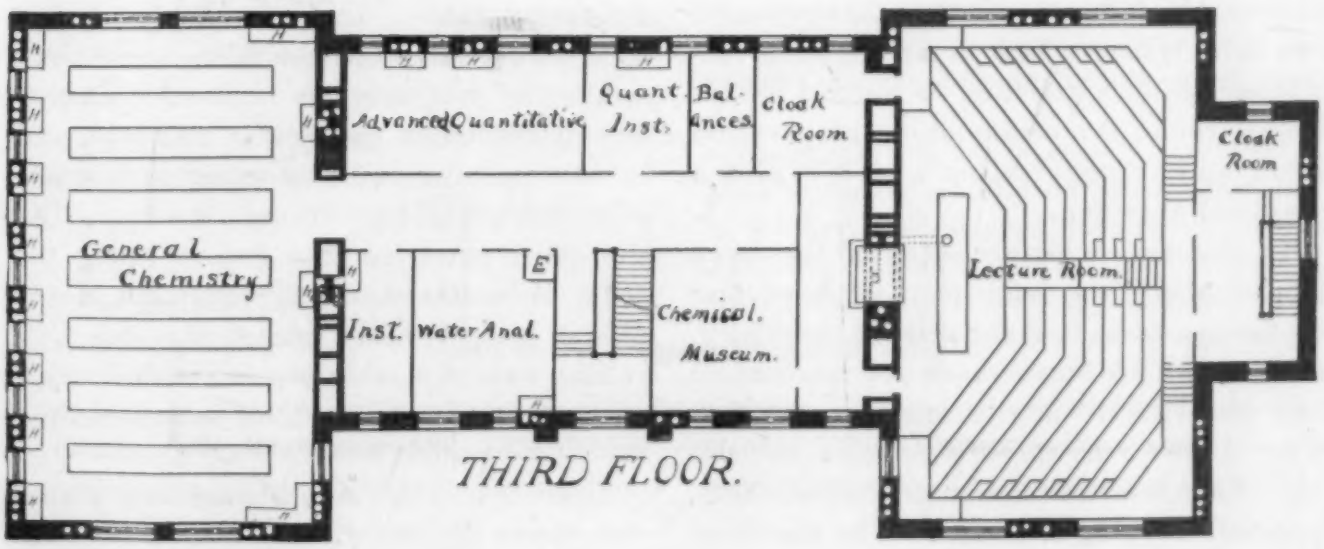
and one-fourth inch hard pine, are separated by a half-inch air space and tarred paper. The corridors are twelve feet wide, and the walls, instead of being built of stone, are of wood, with the spaces between the studs 'nogged' with brick. The building is plastered with 'cement plaster.' At each end of the central portion of the building, as shown in the floor plans, is a four-foot brick wall, which carries the heating flues, and some ventilating flues, where there is space available for them.

The system of heating and ventilation, which has been arranged with special care, includes a fan blower driven by a $11\frac{1}{2}$ K. W., direct current, electric motor; primary coils having 1,900 feet radiating sur-




Physical Chem.
Organic Laboratory
Inst.
Balances
Women
Prof of Phys. Chem.
Advanced Phys. Chemistry.
Senior Pharmacy.
Research
Advanced Organic.
Dark Room
Instruct
Chemical Seminary.
Stores.
Junior Pharmacy.
MAIN FLOOR.


QUANTITATIVE ANALYSIS.
QUALITATIVE ANALYSIS.
Inst.
Private Lab.
Main Office Chem.
Library
Dean's Office
Pharm. Museum.
Balances
Store Room
Organic Lecture Room.
Pharmacy Lecture Room
Dispensing Room
SECOND FLOOR.


General Chemistry
Advanced Quantitative
Quant. Inst.
Balances
Cloak Room
Inst.
Water Anal.
Chemical Museum.
Lecture Room.
Cloak Room
THIRD FLOOR.

face through which the air is drawn and 'tempered'; and secondary coils at the base of the brick walls above mentioned. By means of dampers, which are operated from the several rooms, either tempered or heated air can be discharged into rooms, and thus an abundant supply of fresh air is always assured. This system is completed by removing the foul air from the rooms by means of nine-inch circular tiles connected with the hoods, which are placed between the windows,and indeed at every other point where there is available wall space. There is an eight-inch opening near the bottom of the hood, and a five-inch opening near the top, and the tiles terminate above the peak of the roof, each hood being ventilated by an independent flue, and those flues are grouped into brick chimneys. The construction of the hoods may be understood from the cut of the interior. There are no pipes for gas, water or waste in the hoods, as these are all carried outside and below the floor of the hood.

Referring to the floor plans which are here shown, it will be noticed that there is a separate entrance in the east wing to the pharmacy laboratories on the first floor, the laboratory for pharmacognosy, the pharmaceutical lecture room, with preparation room attached, and the model drug store on the second floor. This same entrance leads to the large chemical lecture room on the third floor, which is arranged to accommodate 325 students. Attached to this lecture room, is a commodious preparation room, and communicating with it is also a chemical museum.

In the west wing are situated the large laboratories of the department of chemistry; on the top floor, that for general chemistry, on the second floor, those for qualitative and quantitative analysis and on the first floor, those for organic and physical chemistry. Each floor accommodates 224 students, one-half working at a time. The basement will be used for special research rooms, assay and metallurgical laboratories, and store rooms.

The offices of the professors of chemistry and of pharmacy and their private laboratories, are on the second floor, so as to be as convenient as possible to all parts of the building, and on the same floor is a library, a balance room, a store room for the dispensing of chemicals and apparatus, and a recitation room which will accommodate seventy-five students. An elevator connects the basement stock room with the store room, and extends to the attic, while a similar elevator at the east end accommodates the pharmacy department.

On the first floor is a smaller laboratory for advanced organic chemistry, with a private laboratory for the instructor, a balance room, lavatory, dark room, a smaller laboratory for physical chemistry, with an office for the instructor adjoining, and a seminary room.

The students' tables in the main laboratories are substantially built of yellow pine, paneled, full one and a-quarter inches thick. Each student is provided with a locker and two drawers, all fastened with a rod which passes through the drawers and is secured by a padlock. At the right or left of each student is a deep sink, twelve inches by thirteen, with a pantry cock for delivering water. Underneath a low bottle rack, which stands on the table, a sufficient number of four-way gas cocks are placed. The panel under the sink is movable, and in this opening the gas, water and waste pipes are brought up through the floor. As the gas pipe is led in a groove along the table under the movable bottle rack, every pipe is easily reached in case of a leak.

The two-inch table top is stained black with an anilin dye, which is not readily acted on by acids or alkalies.

Since the large laboratories are placed one above the other, they can be supplied

by the same system of pipes, and the drainage of the sinks is simple and not liable to get out of order. The drain pipes connect with four-inch delivery pipes on each side of the room, by sanitary T's, and these discharge into soil pipes in the corners. All the drainage is thus taken from the building by four pipes provided with traps, with an additional sewer pipe, of course, to drain the lavatories.

The plan of the building also provides for a system of high pressure steam pipes from the university engineering shops, for blast and vacuum pipes for each room, and for distilled water to be prepared in the attic by boiling water with the high pressure steam. The distilled water is then conveyed to the different laboratories by means of block tin pipes.

There has been expended upon the building the sum of $55,000, leaving some of the less important rooms unfinished, and the furnishings in others incomplete. It is estimated that when the building is completely furnished, as the plans provide, the total cost will be about $80,000.

In the construction of this laboratory no great originality is claimed, but the effort has been made to combine the best features of several of our most modern buildings, as far as this could be done at moderate expense. So far as tested the arrangements for heating and ventilation, perhaps the most important points in laboratory construction, which have some novel features, seem to be very effective. It is believed that greater utility can with difficulty be secured anywhere at the same cost.

E. H. S. BAILEY.

SCIENTIFIC BOOKS.

A Treatise on the Theory of Screws. By SIR ROBERT STAWELL BALL, LL.D., F.R.S., Lowndean Professor of Astronomy and Geometry in the University of Cambridge. Cambridge, The University Press; New York, The Macmillan Company. 1900. Pp. xix + 544, quarto.

Ball's famous work was first given to the world in 1876; later (1889), in a German treatise edited by Gravelius with Ball's cooperation and additions by the editor. Both of these having become inadequate, the present monumental publication, containing a systematic presentation of the present state of knowledge on the subject, was undertaken and completed by the original author. The theory of screws in relation to rigid dynamics begins, on the one hand, with the kinematic theorem of Chasles, that any displacement of a rigid body may be reached by a translation along a definite line called the central axis, and a rotation around it; and on the other hand with the dynamic theorem of Poinsot, that any number of forces or of torques actuating a rigid body in any way may be reduced to a single force and a single couple (collectively a wrench), with the axis of the latter parallel to the direction of the former. The reasoning thence is naturally along the lines of modern geometry or of quaternions, for a screw is a linear magnitude with a definite unit called pitch (advance per radian) associated with it. A twist thus bears the same relation to a rigid body that a vector does to a point. Hence the reader wishing to derive full advantage from Ball's great treatise must be familiar with the modern treatment of geometry. A good account of Ball's theory is given in Schell's 'Theorie der Bewegung und der Kräfte' (Vol. II., Chapter VIII.), as well as in Routh's 'Treatise on Analytical Statics.' However, such is the lucidity of Ball's style, that the reader who knows only the ordinary dynamic methods will find the book accessible somewhere in almost all parts except those specially devoted to higher geometry.

The chapters follow an orderly development: After the fundamental principles are laid down in the first five chapters, equilibrium, inertia, potential, harmonic motion are successively discussed in the four chapters following. Thereafter the six orders of freedom are treated consecutively in nine chapters. The eight remaining chapters deal with the higher development of the subject in ordinary as well as in non-euclidean space. The generality of the methods

will be seen even when the scope of the investigations is limited to conservative forces and infinitely small displacements, for the form of the body does not enter the discussions.

To give an analysis of the book or of Ball's method would be presumption, as Ball did this himself in his inimitable address before the British Association at the Manchester Meeting in 1887, reprinted in *Nature* of the same year, as many of the readers of SCIENCE will remember. Though the address is fourteen quarto pages long, it preserves its exquisite flavor throughout. Ball begins thus: "There was once a rigid body which lay peacefully at rest. A committee of natural philosophers was appointed to make an experimental and rational inquiry into the dynamics of that body. The committee received special instructions. They were to find out why the body remained at rest, notwithstanding that certain forces were in action. They were to apply impulsive forces and observe how the body would begin to move. They were also to investigate the small oscillations. These being settled, they were then to—but here the chairman interposed; he considered that for the present, at least, there was sufficient work in prospect. He pointed out how the questions already proposed just completed a natural group. 'Let it suffice for us,' he said, 'to experiment upon the dynamics of this body so long as it remains in or near to the position it now occupies. We may leave to some more ambitious committee the task of following the body in all conceivable gyrations through the universe.'"

"The committee was judiciously chosen. Mr. Anharmonic undertook the geometry. He was found to be of the utmost value in the more delicate parts of the work, though his colleagues thought him rather prosy at times. He was much aided by his two friends, Mr. One-to-one, who had charge of the homographic department, and Mr. Helix, whose labors will be seen to be of much importance. As a most respectable, if rather old fashioned member, Mr. Cartesian was added to the committee, but his antiquated tactics were quite outmanœuvered by those of Helix and One-to-one. I need only mention two more names. Mr. Commonsense was, of course, present as an *ex officio* member, and valuable service was rendered even by Mr. Querulous, who objected at first to serve on the committee at all. He said that the inquiry was all nonsense, because everybody knew as much as they wished to know about the dynamics of a rigid body. The subject was as old as the hills, and had all been settled long ago. He was persuaded, however, to look in occasionally. It will appear that a remarkable result of the labors of the committee was the conversion of Mr. Querulous himself.

"The committee assembled in the presence of the rigid body to commence their memorable labors. There was the body at rest, a huge amorphous mass, with no regularity in its shape—no uniformity in its texture. But what chiefly alarmed the committee was the bewildering nature of the constraints by which the movements of the body were hampered. They had been accustomed to nice mechanical problems, in which a smooth body lay on a smooth table, * * * in fact the chairman truly appreciated the situation when he said the *constraints were of a perfectly general type.*" Later in the proceedings Mr. Querulous is heard from. "'How could you,' he said, 'make any geometrical theory of the mobility of the body without knowing all about the constraints? And yet you are attempting to do so with perfectly general constraints of which you know nothing.'" The committee having got to work assigned certain duties, whereupon that 'most respectable if rather old fashioned member,' gives an account of himself: "Mr. Cartesian having a reputation for such work, was requested to undertake the inquiry and report to the committee. Cartesian commenced operations in accordance with the well known traditions of his craft. He erected a cumbrous apparatus which he called his three rectangular axes. He then attempted to push the body parallel to one of these axes but it would not stir. He tried to move the body parallel to each of the other axes but was again unsuccessful. He then attached the body to one of the axes and tried to effect a rotation around that axis. Again he failed for the constraints were of too elaborate a type to accommodate themselves to Mr. Cartesian's crude notions."

After further elaborate proceedings, "'Is this all?' asks the chairman. 'Oh no,' replied Mr. Cartesian, 'there are other proportions in which the ingredients may be combined so as to produce a possible movement,' and he was proceeding to state them when Mr. Commonsense interposed. 'Stop! Stop!' said he, 'I can make nothing out of all these figures. This jargon about x, y and z, may suffice for your calculations, but it fails to convey to my mind any clear or concise notion of the movements which the body is free to make.'"

So we might continue quoting every paragraph of this amusing but seriously constructed essay, with equal zest. The book closes with an elaborate bibliography containing all the work relating to the theory of screws from its inception with Poinsot, Chasles, Grassmann, Hamilton, Möbius and Plücker, to the modern advances of Clifford, Klein and their confrères and Ball himself.

CARL BARUS.
BROWN UNIVERSITY.

TOPOGRAPHIC ATLAS OF THE UNITED STATES.

The second folio of what promises to be a magnificent topographic atlas of the United States, published by the United States Geological Survey, has recently been issued. This second number, like the first, bears Henry Gannett's name, and like its predecessor, also presents illustrations of typical topographic forms for the use primarily of students and teachers of physiography. From the large number of topographic sheets issued by the Geological Survey, ten have been selected which furnish admirable examples of well-developed physiographic features, such as a coastal swamp, a graded river, Appalachian ridges, alluvial cones, etc., and bound in a folio, together with brief descriptions and explanations.

The maps have been well selected and in themselves, so far as one can judge who is not intimately acquainted with the areas represented, are all that could be desired. Not only does the field-work seem to have been carefully executed, but the engraving and printing is excellent.

The text accompanying each map is intended to supplement and explain the topographic and culture features shown on it. These descriptions are for the most part evidently compilations from the writings of geologists and geographers, who have studied the areas represented or other similar regions, although no acknowledgments of the sources of information are made. Such references are much to be desired not only in justice to the original investigators, but for the purpose of directing the reader to sources of more extended information. In some instances the maps chosen represent topographic forms which have been carefully studied elsewhere, and might profitably be accompanied by citations from the descriptions of the type examples. Such references and citations could easily be made, as the printed text seldom occupies an entire page: in fact much valuable space is wasted.

Instructive and pronounced features on some of the maps are not referred to in the text, although there is space available. For example, in the description of the Norfolk sheet, the origin of the drowned stream valley, the prominent hills near the ocean's shore presumably dunes, and well-marked characteristics of the shore topography, due to the action of waves and currents, are not mentioned, but in place of such information a questionable explanation of the origin of Lake Drummond is presented. Again, in the text accompanying the excellent map of alluvial cones, no reference is made to the conspicuous channels excavated in their upper portions.

The pictures in the text are poorly printed, and one of them bearing the objectionable name of 'hogback,' is reversed in reference to right and left; this reversion throws the picture out of harmony with the diagram beneath it, intended to show the structure on which the monoclinal ridge depends. In the title of the picture just referred to—and the same is true in at least one other instance—no reference is made to the geographical position of the scene represented.

The diagram described as a 'volcanic neck,' might be accepted as representing a cross-section of a peculiar plutonic intrusion, but by no stretch of the imagination can it be considered as illustrating the structure of a volcanic neck. In attempting to indicate the 'stratified beds now eroded away' they are carried completely

over the intruded mass labeled 'lava,' seemingly with the intention of indicating that the intrusion did not reach the surface. We know, however, from the writings of Major Dutton that the volcanic necks in the Mt. Taylor region, the one selected, are the plugs hardened in the throats of normal craters.

An exception might be taken to the use of the word *crater* in reference to the great depression in the summit of Mount Mazama, but such a distinction I believe, was not made by Dutton and Diller, to whom we owe nearly all our information concerning the region in question.

In the interest of the large number of teachers and students who will consult the topographic folios of the U. S. Geological Survey, I venture to suggest that the descriptions accompanying the maps should be written by persons who are familiar with the regions represented and have a critical knowledge of their geology. These texts, although of necessity brief, should not be stultified compilations, but Nature herself speaking through a master interpreter.

Israel C. Russell.
University of Michigan.

BOOKS RECEIVED.

Animal Life. David Starr Jordan and Vernon L. Kellogg. New York. D. Appleton & Co. 1900. Pp. ix+329.

William Herschel and his Work. James Sime. New York. Charles Scribner's Sons. 1900. Pp. vii+265. $1.25.

The Teaching of Mathematics in the Higher Schools of Prussia. J. W. A. Young. Longmans, Green & Co. New York, London and Bombay. 1900. Pp. xiv+141.

Lehrbuch der vergleichenden Anatomie der Wirbellosen Thiere. Arnold Lang. Second revised edition. First part, *Mollusca.* Karl Hescheler, Jena. Gustav Fisher, 1900. Pp. viii+509.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of School Geography, edited by Richard E. Dodge, of Teachers College, Columbia University, enters upon its fifth volume in January. The editorial staff will be strengthened by the addition of Mr. Mark S. W. Jefferson, of the High School, Brockton, Mass., who will devote his attention to Secondary School Geography, and of Miss Ellen C. Semple, of Louisville, Kentucky, who will, as before, contribute articles and notes in reference to Anthropo-geography.

The Plant World for November opens with an illustrated article on 'An Ornamental Species of *Bideus*' by G. N. Collins. It is a little irregular to learn that the now popular *Cosmos* flower was brought from Mexico twenty years ago and cast aside as a worthless weed. F. M. Burglehaus tells of 'Drying Botanical Dryers in Wet Weather' and Charles Newton Gould describes the 'Jack Oaks in Oklahoma' which are practically useless for anything save firewood. Charles A. White discusses 'The Varietal Fruit Characters of Plants' and 'English and American Weeds [are] Compared' by Byron D. Halsted with the result that in 100 species from each region less than one quarter of them are common to both lists. In the Supplement devoted to 'The Families of Flowering Plants,' Charles Louis Pollard treats of the orders Fogales, Urticales and Proteales.

No. 38, vol. 8, of the *Bulletin of the New York State Museum* is devoted to a 'Key to the Land Mammals of Northeastern North America' by Gerrit S. Miller, Jr., intended to furnish a ready means of identification with the least possible technical requirements. Keys are furnished to the various orders, families, genera, species and even subspecies of the mammals inhabiting the region noted, while references are given to the first publication of each name, the first use of the binomial or trinomial combination and to some recent work in which the animal is described in detail. Recently extirpated animals, such as the bison and walrus, are included and there is a short introduction defining the areas of the life zones of the region under consideration, and before the 'Key' proper is a check list of the 105 species treated. The work is not only useful for the amateur, but of great value to the working zoologist, as Mr. Miller is among our leading authorities on mammals and has devoted particular attention to those of New York State and the adjoining territory.

SOCIETIES AND ACADEMIES.

GEOLOGICAL SOCIETY OF WASHINGTON.

THE 106th regular meeting was held December 12th at the Cosmos Club:

The following papers were presented:

Mr. C. W. Hayes. — 'The Geological Relations of the Tennessee Brown Phosphate.' Three distinct types of phosphate rock occur in Tennessee, named from their prevailing colors white black and brown. The white rock is a recent cavern deposit; the black rock, including two varieties, nodular and bedded, is Devonian and the brown rock is Silurian. At four or more distinct horizons in the lower Silurian occur beds of phosphatic limestone, which, on the removal of the lime by leaching, yield high grade phosphate rock, containing from 70 to 80 per cent. of lime phosphate.

The recurrence of these phosphatic beds through so large a portion of the Silurian and Devonian formations points to a recurrence of similar conditions in Silurian and Devonian time favorable for the accumulation of lime phosphate. The deposits are at present located along the western margin of the central basin of Tennessee in a belt extending nearly across the State. This belt coincides with the western side of the Cincinnati anticline and a genetic connection between the two is suggested. This belt is characterized by numerous unconformities, in part by erosion, but chiefly by non-deposition. During Silurian and Devonian time it was doubtless a region of shallow seas protected from the incursion of foreign detrital sediments. Under these conditions the lime carbonate was perhaps removed by solution nearly as fast as deposited, and the lime phosphate which elsewhere is disseminated through a great mass of limestones was here concentrated into a relatively small volume.

Mr. Lester F. Ward. — 'The Autochthonous or Allochthonous Origin of the Coal and Coal Plants of Central France.' Mr. Ward accompanied the excursions of the International Geological Congress to the coal basins of Commentry, Decazeville and Saint Etienne, and found this to be the principal geological problem presented. M. H. Fayol led the party through the two first-named basins, and lost no opportunity to demonstrate to the excursionists the validity of his well-known theory of deltas, according to which all the materials have been transported from the surrounding country and deposited in small lakes which have been thus gradually filled up. The excursion to St. Etienne was in charge of M. C. Grand'Eury, whose elaborate treatment of the 'Coal Flora of Central France' is familiar to all. He was not less zealous in seeking to make clear the autochthonous origin of the coal plants of that basin. Among the members of the party were Dr. I. C. White, M. H. Potonié and other competent judges of such questions. None of them had any *parti pris*, and all were open to the evidence, which, however, all admitted was in certain respects more or less defective. This was the fault of the conditions, and not at all of the able and courteous expounders of the respective theories. The result at least could not be positively stated in favor of either theory for all the beds, but M. Fayol may be said to have given a correct explanation of the mode of deposition of the Commentry basin and probably of most of that of Decazeville, although in the latter the underclays certainly hold the roots of plants. At St. Etienne M. Grand'Eury showed the party many cases in which the finest fibrils of the roots of erect Calamites were seen to pass across the planes of bedding and penetrate to the underlying conglomerates which formed the original floor; a condition which is wholly incompatible with the theory of transportation or the slightest disturbance of the plants.

Mr. E. E. Howell. — 'A New Geological Relief Map of the United States.' This map, exhibited to the Society, is on a horizontal scale of about 40 miles to the inch, representing a portion of a globe 16½ feet in diameter. The vertical scale is eight miles to the inch. The geological data was obtained from the U. S. Geological Survey.

F. L. RANSOME,
DAVID WHITE,
Secretaries.

CHEMICAL SOCIETY OF WASHINGTON.

A REGULAR meeting was held October 11, 1900. The evening was devoted to the address of the retiring president Dr. H. N. Stokes, on

the subject, 'The Revival of Organic Chemistry.' SCIENCE, October 12th.

A regular meeting was held November 8, 1900. The first paper of the evening was read by Mr. L. M. Tolman, and was entitled, 'The Examination of Jellies, Jams and Marmalades,' by L. M. Tolman, L. S. Munson and W. D. Bigelow. The paper gave the results of the examination of jellies and jams manufactured in the laboratory from 13 varieties of fruits. The solids, ash, acid, nitrogen, reducing sugar and cane sugar, were determined, and the amount of cane sugar inverted and calculated. The juices and pulps from which the samples were made were also examined. The relation between the acid content and the amount of cane sugar inverted was especially noted.

The second paper was read by Dr. Bigelow and was entitled, 'The Nitrogenous Compounds of Meat Extracts,' by W. D. Bigelow and R. Harcourt. The authors examined about fifty commercial extracts making use of the following methods: Precipitation by bromin as directed by Allen; precipitation by zinc sulphate; precipitation by ammonium sulphate; precipitation by bromin in filtrate from the zinc sulphate precipitate; precipitation by tannin and phosphotungstic acid (filtered separately), the latter precipitate being filtered at about 90° C., as directed by Mallet. The bromin precipitate from the original solution was found to hold only a small and variable portion of the proteids present. The zinc sulphate precipitate plus the bromin precipitate in the filtrate from the same gave results which were fairly satisfactory. The best results were obtained by use of the Mallet's method. Mixtures of digested egg albumin and purified meat bases were also subjected to the above methods.

WILLIAM H. KRUG,
Secretary.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF GEOLOGY AND MINERALOGY.

THE section met on November 19th, Dr. A. A. Julien presiding. The following communications were presented:

'Recent Progress in Investigation of the Geology of the Adirondack Region,' by J. F. Kemp. Three classes of rocks are present in the area discussed: (1) those certainly igneous in their nature, including labradorite rocks, basic gabbros and trap dikes; (2) those certainly sedimentary, best illustrated by the crystalline limestones; (3) extensive areas of gneiss of uncertain origin. The distribution of the first class and the results obtained have been quite accurately ascertained by H. P. Cushing, C. H. Smyth and the speaker. The augite-syenite first discovered by Cushing near Loon Lake has since been found to be widely distributed in regions farther south. The ages of the trap dikes and their distribution were discussed.

Recent additions to the knowledge of the sedimentary rocks involve the recognition of quite large amounts of quartzites in a considerable number of new localities. Besides these, small beds of limestone have been discovered in the southern areas, especially in Warren and Washington counties, which are thoroughly interstratified with the gneisses and which leave no escape from concluding that the gneisses are also sedimentary in their origin and that a regularly stratified series of rocks is present. This conclusion removes many of the gneisses from the group of uncertainties.

The speaker enumerated the discovery of new outliers of Cambrian and Ordovician strata in the midst of the crystallines. He also noted the distribution of the glacial striations throughout the eastern mountains and their nearly uniform northeasterly bearing. The physiography is chiefly due to a series of faulted blocks which afford a very characteristic saw-toothed sky line.

'Notes on the Origin of the Pegmatites from Manhattan Island by A. A. Julien.

Dr. Julien, after discussing the prevailing theories of the origin of pegmatites, and showing that they did not adequately explain pegmatitic developments *in loco* in the districts mentioned, advanced the following conclusions:

1. The existence of at least two series of pegmatite developments, marked by a succession of intersections. Of these the oldest series is the most extensive, intercalated among the foliation-seams, and coincident with the strike. The later series cuts the schists in all directions and inclinations.

2. Every pegmatite occurrence on Manhat-

tan Island retains more or less structural evidence of having begun its existence as a vein, segregated from a magma or igneo-aqueous emulsion. Even the notable dike near 205th Street, crossing the dolomite, retains the vein structure, perfectly in places and imperfectly throughout.

3. Contact phenomena are confined mainly to the earlier alteration along seams, to projection of veinlets rather than intrusion pophyses, and, at one dolomite intersection, to a thin selvage of phlogopite and tremolite.

4. The vein structure presents distinct lamination, correspondent deposits on the two walls, comb structure, passage from less to more acid minerals toward the center, and final concentration of minerals of the rarer elements in association with the significant matrix, smoky quartz, along lenticular bands, often near a central suture.

5. Some of the most prominent features are the results of pressure upon the original veins through orogenic movements of the stratum of schists, viz., fissuring, faulting, crushing, shearing with development of aplite, refusion and development of new phenocrysts (granite-porphyry), and generation of reaction borders outside of each wall of a vein. Where flowage has taken place and some transferrence of the crushed vein material along the plane of the vein, the appearances of a dike begin. Many of these results may be distinguished along the course of the same vein at short intervals, but in the most characteristic dikes the vein structure is rarely, if ever, completely obliterated.

THEODORE G. WHITE,
Secretary.

SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

A MEETING of the Section was held at 12 West 31st Street, New York, on the evening of December 3, 1900.

Professor E. R. von Nardroff presented a paper with an experimental illustration, on 'The Determination of the Wave-Length of Sound by the Grating Method.' As a source of sound the author used a miniature steam whistle made of brass and operated by a current of air from a tank of compressed air. The sound produced in this way was inaudible on account of its high pitch, the wave length being only about three-eighths of an inch. The whistle was placed at one of the conjugate foci of a parabolic metallic mirror, a sensitive flame being placed at the other conjugate focus. A transmission grating made of wood, and resembling somewhat a portion of a picket fence, was then interposed in the path of the reflected sound waves, and it was found that when the sensitive flame was shifted to one side, as many as four positions of maximum effect were obtained on each side of the central direct beam of sound. With this apparatus, the wave-length of sound, when the waves were short like those used, could be measured to within one per cent.

Mr. W. G. Levison read a paper on 'A Method of Photographing the Entire Corona on One Plate,' employed at Newberry, S. C., for the total solar eclipse of May 28, 1900. The method consisted in the employment of a specially constructed color screen most dense at the center and fading off to clear glass at the edges, which was placed close to the photographic plate. The size and density of the screen were adjusted as nearly as possible so that the image of the inner corona made by a suitable lens fell on the part of the plate covered by the screen, while the image of the outer corona passed through the clear glass. The color screen was made from a lens of colored glass with sharp edges which was cemented into a recess in a plate of clear glass, ground to receive it. Two screens were made, one of orange-yellow glass and one of dark greenish-blue glass. In testing these screens at the time of the eclipse, an arrangement of telephoto-lenses was used, but unfortunately the exposure was not long enough to give any image at all of the outer corona through the clear glass, although a considerable impression of the inner corona was produced through the orange-yellow glass, but none through the bluish-green glass. This should give some idea of the relative actinometric intensity of the light from the inner and from the outer corona.

Mr. Levison also presented a short note on 'The Action of Canada Balsam on Photographic Plates.' In making the experiments with the color screens he noticed that Canada balsam

that had been baked hard, when placed in contact with a sensitive plate, or separated from it by a layer of carefully selected black paper, and allowed to remain a week or more, affected the plate in the same manner as light, the part affected developing black. He verified this effect by a number of experiments. In the author's opinion this effect seemed likely to be caused by true Becquerel rays, as it passed through the black paper, which is perfectly opaque to ordinary light.

William S. Day,
Sec'y of Section.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

The regular meeting of the Section was held on Friday evening, December 7th, at the Chemists' Club, 108 West Fifty-fifth Street, Dr. C. A. Doremus presiding.

Special invitations had been sent out to those interested in public water supply, as the feature of the meeting was an address by Professor William P. Mason, of the Rensselaer Polytechnic Institute, Troy, entitled, 'The Water Supplies of the Cities on the Mediterranean,' with lantern illustrations.

The address began with a description of Gibraltar, and its peculiar arrangements for water supply. From there to Tunis and other cities on the south shore, including the site of ancient Carthage; then to Naples and Rome.

The system at Naples, once so primitive and unsanitary, is now on a scale and of a character to command admiration.

The typhoid epidemic at Hamburg in 1892 was alluded to, and a 'spot' map gave a graphic representation of the severity of the scourge in Hamburg, and the comparative immunity of the adjoining town of Altona, which, while having a separate water supply, was not more separated from Hamburg than Harlem from the rest of New York City.

A still more remarkable fact emphasized the value of filtration. The water supply of Altona was taken from below the sewers of Hamburg, passing through sand filters before distribution.

At the close of the address a vote of thanks was passed, and some routine business attended to. Four representatives in the council were elected, and a committee of three was appointed to confer with the Bureau of Combustibles in regard to the present existing restrictions as to storage of nitric, hydrochloric, and sulphuric acid.

Messrs. T. J. Parker, A. P. Hallock and William McMurtrie were appointed on this committee.

The situation, as it now stands, is such that a permit can be obtained for 1,000 pounds only of the acids named, whereas many establishments are using more than this amount every 24 hours, and, aside from the difficulty of having the acids delivered each day, any interference with daily delivery would result in suspension of large and important industries.

Durand Woodman,
Secretary.

THE NEBRASKA ACADEMY OF SCIENCES.

The Academy held its eleventh annual meeting in Lincoln at the University of Nebraska, on Friday, November 30th and on Saturday, December 1st. This was without doubt the most important as well as the most interesting meeting the Academy has ever held. The number of papers presented (as well as their subject matter) was especially noticeable for its high character. The meeting was called to order and presided over by President H. Gifford, who took for his address 'A Possible Explanation of the Shape of the Human Auricle.' This address was illustrated by well selected figures on charts and photographs, showing the external ear as found in a number of different types of animals both terrestrial and aquatic. In his treatment of the subject, Dr. Gifford called attention to the presence of a number of small muscles in the ear as found in these animals and indicated their influence in bringing about the prevailing form of this organ as found in man.

Professor Haven Metcalf presented a very interesting paper on 'Problems relating to the Individuality of Chromosomes,' which was discussed by Professors Duncanson, Metcalf and Ward. In this paper certain characteristics of these bodies were cited as explanatory of the possible ancestry of different hybrid plants.

Another paper that attracted an unusual amount of attention was that of Professor E. H.

Barbour on 'Sand-lime Crystals.' This latter paper was certainly an important contribution to the subject of crystallography, and will be received by geologists as a permanent contribution to the subject. Immediately following this paper some time was spent by Robert E. Moritz in presenting a discussion on the 'Extension of the Differential Processes' in a manner approved of by the mathematicians in attendance. Robert H. Wolcott then read by title a rather technical paper entitled 'A Review of the Genera of Water Mites,' in which the auther critically reviewed all the former attempts at the classification of these animals. He also suggested in that paper a more natural scheme of classification based on the derivation of the different forms aside from their chance present external resemblances.

Another paper of more than ordinary interest was that of Professor William Hastings, entitled 'The Nebraska Type or Norm for each School Age, and Vitality Coefficients.' 'Thunder Storms' was the title of a paper by J. H. Spencer, in which the author gave a very concise description of what constitutes such a storm, its cause, method of development, extent, importance, and the comparative annual number of such storms for the State of Nebraska and surrounding regions.

The feature of the evening session was the presentation of papers of a more general nature. Some of these were 'Notes on the Occurrence of Asparagus Rust in Nebraska,' by J. L. Sheldon; 'The Determination of the Longitude of the University of Nebraska Observatory,' by G. D. Swezey; 'A Report on the Morrill Geological Expedition for 1900,' by E. H. Barbour; 'Additional Observations on Plant Movements,' Wm. Cleburne; a paper on the 'Delimitation of the Field of Pedagogy,' by W. A. Clark, and one on 'Degeneracy,' by Dr. H. B. Lowry. In his presentation of this latter subject the doctor dealt chiefly with the criminal phase. It is needless to state that this paper will form very interesting reading when published.

The papers presented at the session on the morning of December 1st were 'The Geology of Saunders, Lancaster and Gage Counties,' by C. A. Fisher; 'North American Bees of the Genus *Agapostemon*,' by J. C. Crawford, Jr.; 'The Work of the State Geological Survey during the Summer of 1900,' 'Bone Tissue, Recent and Fossilized,' and one on the 'Extent of the Fiberous Arikaree Beds,' by E. H. Barbour; 'Some Tests of Camera Shutters,' G. D. Swezey; 'Notes on Beet Diseases in Nebraska,' Geo. G. Hedgecock; 'A Brief Account of some Rare Alaskan Worms,' H. B. Ward; 'Observations on Species of Nebraska Water Mites,' Robert H. Wolcott; 'Report on the Botanical Survey of Nebraska,' Roscoe Pound; 'Additions to the List of Nebraska Fossils,' Carrie A. Barbour, and 'Some Impressions of Biological Conditions in Arizona,' A. A. Tyler. As nearly all these papers were more or less technical in their nature, or of minor general interest, they were presented by their authors in abstract.

The officers elected for the ensuing year are: Ellery W. Davis, President; J. H. Powers, Vice-President; Robert H. Wolcott, Secretary and Custodian; G. A. Loveland, Treasurer; Board of Directors: William Cleburne, C. H. Gordon, H. B. Lowry and L. Bruner.

On motion of the chairman of the committee on publication it was decided to publish at once the proceedings of the present meeting, also the proceedings of the last two meetings, which have been held in abeyance awaiting the publication of the report of the Nebraska Historical Society with which they are to appear.

A committee of three was also appointed to await upon the members of the coming legislature for the purpose of securing any possible State aid in the future publication of the Academy's proceedings.

LAWRENCE BRUNER,
Secretary.

DISCUSSION AND CORRESPONDENCE.

A GASOLINE LAUNCH FOR FIELD WORK.

TO THE EDITOR OF SCIENCE: Three years ago I published in your columns a few brief statements regarding the feasibility of using gasoline for motive power in conducting geological work in the Eastern United States, and more particularly in New York. Since then several long, and I may venture to say successful, excursions have been made. It is, however, to show the

aid which power of this kind can give to regular university work in field geology that this communication is written.

The Cornell Summer School of Field Geology had for headquarters this season the classic region of Trenton Falls, N. Y., where collecting, section-making, map-making, etc., were carried on in great detail. At different times the two divisions of the class were taken by boat along the Erie Canal to Troy, and, by short railway trips to the Helderberg Mountains, the Cambrian east of Troy and to Oriskany Falls. The farthest north reached by boat was Plattsburg on Lake Champlain. During the summer the students had an opportunity to study the Archæan at several localities, also the Lower and Upper Cambrian, the Calciferous, Chazy, Birdseye, Black River, Trenton, Utica, Hudson River, Clinton, Onondaga, Water Lime, Lower Pentamerus, Delthyris shaly, Upper Pentamerus, Oriskany, Cauda-galli, Schoharie, Corniferous, Marcellus and Hamilton formations. Owing to boat accommodations, the class was limited to fifteen (four women and eleven men) though many more applications for admission to the class were made.

For the coming summer (1901) there will be room for forty-five. The Helderberg Mountains (Country man hill section) will be used as a rendezvous, where a camp will be formed similar to that of the past summer at Trenton Falls. This place has been selected because of the large number of formations (about a dozen) accessible within a radius of one mile. Excursions by boat down the Hudson to Rondout, up the Champlain to Valcour Island, westward on the Erie Canal to Syracuse, will be made without fail.

Many of the places visited could be reached by rail supplemented by hack drives, but I venture to say not so economically for the student. By camping and cooperation in the work, no one need spend over $65 for a ten-week term. This includes tuition, board and everything, and is the result of experience and not a mere estimate. Compare these figures with estimates of expenses as usually given in announcements for summer schools of field geology (usually for six weeks only) and observe the difference. Special attention is called to this fact, for it has often seemed to the writer that not enough consideration is usually given to the class of students who would profit most by opportunities for field work.

That the most advantageous place to study geology is in the field is too obvious to need any explanation here. The drawback in such work is the expense. In a recent English publication we read: "Would that some munificent person would found in the basin of the river Ribble a geological station where Cambridge students would have the means of acquiring a knowledge of field geology under conditions more favorable than those presented by the flats around the sluggish Cam."* The points of special note in our method of work, with the Helderbergs as a center of operation, are the following: (1) The mountains were long ago recognized by the illustrious Lyell and others as most ideal for geological study. (2) By camping and cooperating in camp duties we can make fair progress without the 'munificent person' so often appealed to. (3) By making long excursions by boat in various directions a far broader view of geology can be obtained than by remaining all the time at one station, however well it may be equipped, or however well located. (4) The more advanced student can keep his eyes open and ask the party to stop and stay at localities affording new materials so long as seems advisable.† There is no hurrying to catch trains and no fear of the oncoming of the night. Original work can accordingly be done to great advantage, serving not only to advance our knowledge of geological science, but also to demonstrate to the less advanced students the meaning of real geological work.

Gilbert D. Harris.

Cornell University,
December 8, 1900.

CURRENT NOTES ON METEOROLOGY.

de saussure's essays on hygrometry.

No. 115 of Ostwald's 'Klassiker der exacten Wissenschaften,' is a German translation of de Saussure's 'Essais sur l'hygrométrie,' which

* 'The Principles of Stratigraphic Geology,' by J. E. Marr, 1898, p. 98.

† See *Bull. Amer. Paleont.*, No. 13, November, 1900.

were originally published at Neufchâtel in 1783. This useful series of reprints also contains two other volumes of distinctly meteorological interest, viz., No. 57, 'Fahrenheit, Réaumur, Celsius, Abhandlungen über Thermometrie. 1724, 1730–1733, 1742,' and No. 58, 'Otto von Guericke's neue Magdeburgische Versuche über den leeren Raum., 1672.' The work of de Saussure in connection with hygrometry was of marked importance, and it is well to have interest in it revived by means of this attractive little volume, the price of which is but 2 m. 60 Pf. The book contains a brief biographical sketch of de Saussure, and also a number of notes on the text. The publisher is Engelmann, of Leipzig.

BRITISH RAINFALL FOR 1899.

THE fortieth volume of 'Symons's British Rainfall,' that for the year 1899, is the first one of the long series of these annual reports which has been compiled by anyone but Mr. Symons himself. Owing to the death of the founder of the British Rainfall service on March 10, 1900, the duty of compiling the annual report has devolved upon Mr. H. S. Wallis, who was associated with Mr. Symons for 30 years. 'British Rainfall' for 1899 appropriately contains an appreciative notice of Mr. Symons's life and work, together with an excellent portrait of that distinguished meteorologist. The number of observers from whom records are received is now about 3,500. Besides the usual full presentation of the results of the year's observations, the present volume contains a discussion of the average rainfall of the decade 1890–99, as determined by records at a hundred stations well distributed over England, Scotland and Ireland.

SCIENTIFIC BALLOON VOYAGES.

NOTICE has been received of a new work on balloon meteorology, issued by Friedr. Vieweg und Sohn, Braunschweig. The title of the work is 'Wissenschaftliche Luftfahrten, ausgeführt vom Deutschen Verein zur Förderung der Luftschiffahrt in Berlin.' The authors are Drs. Assmann and Berson, and associated with them are the following well-known meteorologists or aëronauts: Baschin, von Bezold, Börnstein, Gross, Kremser, Stade and Süring. There are three volumes. The first deals with the history of balloon ascents and with the instruments and their use; the second contains accounts of individual ascents, and the meteorological results obtained on them, and the third volume summarizes the whole subject, giving the most important results. The price of the work is 100 Marks.

R. DEC. WARD.

YELLOW FEVER AND MOSQUITOES.

MEDICAL authorities are by no means agreed as to the value of the experiments on the relations between yellow fever and mosquitoes carried out at Havana by Drs. Reed, Carroll, Agramonte and Lazear. The *British Medical Journal* remarks editorially: "At first glance these experiments appear to show almost conclusively that the germ of yellow fever is conveyed by a special species of mosquito — *Culex fasciatus*, presumably—and that the insect becomes infective only after from ten to thirteen days from the time of ingestion of the germ. Unfortunately the mode in which the experiments were conducted detracts much from their value. They are really by no means conclusive. The experimenters themselves are of this opinion. At most they are suggestive. It is to be regretted that, considering the great danger to which the subjects of these experiments were exposed, greater care was not exercised that the conditions of the experiments were absolutely free from objection. If life was to be risked, it was surely imperative that this risk should not be incurred in vain; that it should be unnecessary to go over the ground afresh, and thereby entail further risk.

Manifest objections to the conclusion that the mosquito did convey the disease in the three cases which yielded a positive result are, first, that nine out of the twelve individuals subjected to mosquito bite did not contract yellow fever; secondly, that those individuals who did contract the disease had entered the local endemic yellow fever area about the time they were bitten; they might have contracted the disease in the ordinary way, therefore, and not from the experimental mosquitoes; thirdly, that the germ of yellow fever has been recognized neither in the mosquito nor in human blood.

Dr. Lazear's life has not been altogether thrown away if these experiments lead, as they must, to their repetition under more rigid conditions, and if it be found that yellow fever is conveyed by the mosquito, the important sanitary measures which will result from the discovery will atone, in a measure, for the regrettable sacrifice. Meanwhile the bacillus icteroides of Sanarelli is being discredited, and, like so many of its predecessors, may have to give place to some other microorganism, in this case, possibly, of a protozoal nature.

UNINSULATED CONDUCTORS AND SCIENTIFIC INSTRUMENTS.

In his inaugural address as president of the British Institution of Electrical Engineers delivered on November 8th, and published in *Nature*, Professor John Perry urged the importance of scientific and mathematical training for electrical engineers. He said: "In this address I mean to put before you this simple question: Is electrical engineering to remain a profession or is it to become a trade? Is this Institution to continue to be a society for the advancement of knowledge in the applications of scientific principles to electrical industries, or is it to become a mere trades union?"

Professor Perry, in the course of his address referred to the use of insulated return conductors in connection with electrical transportation, where uninsulated conductors may disturb scientific instruments, saying:

"At Potsdam this sacrilege has been forbidden. At Washington, Toronto, Capetown and most other important places, the magnetic records have already been rendered useless. Professor Rücker and I were asked by the other members of the Committee of the Royal Society which was in charge of the Kew Observatory to defend Kew, and with the help of her Majesty's Treasury we thought we were able to insist upon the use of insulated returns in all undertakings authorized by Parliament where harm was likely to be inflicted on Government observatories. * * * We were, however, mistaken, for the only clause which we have been able to get inserted in all Parliamentary authorizations of undertakings leaves it to the Board of Trade to substitute other methods of protection than the insulation of the return conductors in cases where these other methods seem to be sufficiently good for the protection of laboratories and observatories, and this is why the Board of Trade appointed the committee which met on October 31st, probably for the last time. * * * I beg to assure you that I have been acting in your best interests. As an electrical engineer I ought surely to regret the use of uninsulated returns, even if we leave Kew Observatory out of account. Suppose we do not now insulate our returns. Electricity will certainly return by gas and water pipes and the amount of harm done to those pipes is merely a question of time. Because of the ignorance of legislators and gas and water companies, nothing is said just now; but will nothing be said at the end of ten or twenty years, when pipes are found to be eaten away everywhere? And if by a slight increase of expense, or rather, as I think, actually no increase of expense, but merely a little increase in inventiveness and common sense on the part of electrical engineers, this evil may be entirely prevented, surely it is in the interests of all of us that insulated returns should be insisted upon. But even if we do not insist on insulating the returns in all systems, surely something may be said for the giving of this protection on lines near such a magnetic observatory as Kew. Even the magnetograph records now being made have been continuous for forty five years, and if Kew is interfered with no sum of money can compensate for the interference; for if the observatory were removed the future observations would have no link with the past."

SCIENTIFIC NOTES AND NEWS.

The programs of the scientific societies in session during Christmas week at Baltimore, Chicago, New York and Albany show that an interesting series of meeting will be held. We hope to publish in early issues the official addresses and discussions, together with accounts of the meetings.

Dr. G. A. Miller, of the mathematical department of Cornell University, has just been awarded the prize of $260 offered by the Royal Academy of Sciences of Cracow, for researches in the theory of groups.

PROFESSOR W. G. JOHNSON, state entomologist at the Maryland Agricultural College, has resigned to become editor of the *American Agriculturist.*

Dr. PETER M. WISE has been removed from his office as president of the State Commission in Lunacy by Governor Roosevelt on the charge of soliciting subscription to a mining company of which he was president from his official subordinates. It will be remembered that Dr. Wise was largely instrumental in the curtailment of the work of the New York State Pathological Institute.

DR. JOHN J. ABEL, professor of pharmacology in the Johns Hopkins University, was injured in an explosion in his laboratory on December 19th. He was taken to the Johns Hopkins Hospital and it is feared that his eyesight may be injured.

PROFESSORS J. W. TYRELL and J. W. Bell, of the Canadian Geological Survey, have returned to Vancouver, after an expedition extending 5,000 miles through the Barren Lands of northern Canada. The party is said to have secured much valuable geological and other scientific information.

ON December 20th, Dr. George Bruce Halsted and Professor Wm. M. Wheeler started from Austin on an expedition into southern Mexico. Professor Wheeler will collect and study Mexican ants. Dr. Halsted is interested in the anthropological exploration of 'La Mesa Cartujanos,' and will also be at Mitla.

THE Academy of Sciences of Vienna will send a botanical expedition to Brazil next year under the direction of Dr. Richard von Wettstein, director of the Botanical Garden of the University of Vienna, and Dr. Viktor Schiffner, professor in the German University at Prague.

OWING to the retirement of Mr. Charles Whitehead, F.L.S., F.Z.S., from the position of technical adviser to the Board of Agriculture, it has been arranged that the scientific and expert assistance required by the Board in connection with these subjects will be furnished respectively by the Royal Botanic Gardens, Kew, and by the Natural History Departments, South Kensington.

THE committee on the trust founded by the late Sir John Lawes for the purposes of scientific investigation and experiments in connection with agriculture held its first meeting since the death of its founder, when the following resolution was unanimously agreed to: "That the Lawes Agricultural Trust Committee desires to place upon record its deep sense of the irreparable loss it has sustained by the sad and unexpected death of Sir John Bennet Lawes, to whose munificence the trust owes its existence, and to whose wise counsels and hearty cooperation any success that may have attended the operations of the committee has been largely due."

THE Huxley Memorial Committee has just issued its final report and donation list. The total sum at the disposal of the committee was £3,405, 10s, 2d. The total cost of the statue, now in the Natural History Museum, London, was £1,813, 18s, 8d. The cost of preparing the Huxley gold medal, to be awarded by the Royal College of Science, was £263, 17s. The surplus of the fund being insufficient to provide a third object of memorial, as originally contemplated, the whole sum of £1,126, 6s, 4d. has been invested as an endowment for the medal. The committee has, however, arranged with the council of the Anthropological Institute to allow them the use of the obverse die, for the production of a presentation medal, of which that body will provide the reverse die and impression, in commemoration of Huxley's labors as an anthropologist. The committee also recalls the generous action of the Hon. J. Collier in painting a portrait of Huxley and presenting it to the National Portrait Gallery. The list of subscribers contains about 750 names, without reckoning individually the many who subscribed through local societies and committees.

DR. J. BOERLAGE, assistant director of the Botanical Garden in Buitenzorg died recently while on a scientific expedition to Ternate.

THE death is announced of Dr. G. Hartlaub, the eminent German ornithologist, at the age of eighty-seven years.

DR. A. W. MOMERIE, formerly professor of logic and metaphysics in King's College, London, and the author of numerous books on

philosophical and theological subjects, died on December 6th at the age of 52 years.

We regret also to record the deaths of the following men of science: Dr. Theodor Adensamer, assistant in the Natural History Museum in Vienna; Dr. August Böttcher, physicist in Berlin; Dr. Adolf Stengel, professor of Agriculture in the University at Heidelberg, and Father Amand Davis, corresponding member of the Paris Academy of Sciences in the section of geography.

It will be remembered that the late Professor Hughes left £4,000 to the Royal Society for the establishment of a prize. The Society has now decided to award annually a gold medal, to be called the Hughes Medal, not exceeding in value the sum of £20, together with the balance of the income, to such person as the president and council may consider the most worthy recipient, without restriction of sex or nationality, for original discovery in the physical sciences, particularly in electricity and magnetism.

At the banquet of the Royal Society on November 30th the Swedish and Norwegian Minister, in replying to a toast, said that the prizes to be awarded by each of the five Noble institutes would amount to about £8,000 annually.

The Committee of the National Educational Association charged with selecting the place of meeting for the year 1901 has voted in favor of Detroit. The meeting will be held in July. The Association met at Detroit in 1874.

A science club has been organized in Las Vegas, New Mexico. At the first meeting held early in December, Mrs. Wilmatte P. Cockerell referred to the tendency of the butterfly *Argynnis nitocri* to develop distinct races on isolated mountain ranges, and exhibited a new race from Sapello Cañon, N. M., which it was proposed to call var. *nigrocærulea*. Mr. Emerson Atkins exhibited some rodents which he had collected in the mountains near Las Vegas, including specimens of *Sciurus fremonti*, which appear to indicate that the subsp. *neomexicanus* of Allen could not be maintained, but must be referred to subsp. *mogollonensis*. He also showed examples of a *Tamias* which served to connect *T. quadrivittatus*, Say., with *T. cinereicollis*, Allen, indicating that the latter should apparently be regarded as a subspecies of the former. Mr. T. D. A. Cockerell exhibited and discussed some parasites found in the nest of the bee *Anthophora occidentalis*, Cresson, at Las Vegas. These included the metoid beetles *Leonidia neomexicana* (Ckll.) and *Meloe sublævis*, Lec., the former only known heretofore by a single example, and the chalcidid *Monodontomerus montivagus*, Ashm.

Professor F. H. Herrick has been invited to give a lecture on 'The Habits and Instincts of Wild Birds' at Trinity, before the Hartford Scientific Society on January 15th. He will give the same lecture at Yale University, before the Scientific Society of Sigma Xi, on January 17th; at Brown University, before the Rhode Island Audubon Society, on January 17th, and at Dartmouth College on January 18th.

The Hungarian Minister of Education recommends the appropriation of 332,000 crowns for the establishment of a general pathological institute together with a Pasteur institute at Buda-Pesth.

Drs. Sambon and Low have returned to England, after the summer spent in the mosquito-proof hut in the Roman Campagna. They are in excellent health, though it is said that the past summer was exceptionally malarious. For example, fifteen or sixteen police agents were sent to Ostia, and though they only remained a night in the place, they all developed fever.

A cable dispatch to the New York *Sun* states that investigations of the causation of yellow fever now being carried on at Marinao have so far confirmed the report of the Surgeon-General's commission. Five soldiers who have kept themselves protected from mosquitoes have been living in infected clothes and sleeping in infected beds for twenty days and have not yet developed any symptoms of the disease.

At its annual meeting on December 14th the American Forestry Association recommended that a national park be established in Minnesota and that the California big trees be preserved so far as possible.

WE learn from the London *Times* that very striking evidence of the shrinking up of Lake Tanganyika was furnished in the paper read recently in Brussels by Captain Hecq, who stated that the post of Karema, founded 20 years ago on the shores of the lake, was now fourteen miles distant from the lake. Captain Hecq also recently visited Lake Kivu, the waters of which are so salt that neither crocodiles nor hippopotami are to be found in it. This lake is given the appearance of being divided into two by a large island, and this may explain some generally accepted errors which are now being definitely solved by a German-Congolese boundary commission.

A RESOLUTION has been adopted unanimously by the French Chamber of Deputies calling upon the government to prohibit the manufacture and sale of all alcoholic liquors pronounced 'dangerous' by the Academy of Medicine. The resolution is especially concerned with the consumption of absinthe, which continues to increase in France.

THE Buffalo Society of Natural Sciences expects to cooperate with the New York State Museum in making an exhibit at the Pan-American Exposition, at Buffalo, in 1901. This exhibit will be held in the New York State building. An especially fine collection from the water-line rocks near Buffalo, consisting of the fossil crustaceans—*Pterygotus*, *Eurypterus*, and *Ceratiocani* will be shown. This collection is being mounted for exhibition at the State Museum.

The London *Times* states that in view of the fact that the Royal Institution of Civil Engineers has, by a decision of the House of Lords, been exempted from payment of the Corporation Tax (1894), it is submitted that the Royal Colleges of Physicians in London and Edinburgh may reasonably claim similar treatment; and an attempt is being made by Sir John Tuke to induce the Chancellor of the Exchequer to concur in this view. The especial hardship in this case is that, notwithstanding the important part played by the two colleges in administering and regulating medical education and examination, and in maintaining laboratories for original research, and the obligation upon each fellow to pay a stamp duty of £25 on election, there will be five years of arrears to make up if the authorities persist in their intention to levy the tax.

WE learn from the *Electrical World* that the International Conference sitting in Brussels for the Protection of Industrial Property, at which United States Assistant Patent Commissioner, Walter H. Chamberlin, and Lawrence Townsend, United States Minister to Belgium, were the American representatives, adopted the following resolutions: First—The period of exclusive rights, previously fixed at six months for [applications for] patents and three months for industrial designs, models and trade marks, is extended to a year for the first named and four months for the second named. Second—Countries signing the convention enjoy reciprocally the protection accorded by each country to its own citizens against unfair competition. Third—Patents cannot lapse because they are not put in circulation, except after a minimum delay of three years, dating from the first application in countries where the patent is allowed and in cases in which the conditions of the patent do not justify causes of inaction.

AT a meeting of the Zoological Society of London, on December 4th, Mr. J. S. Budgett read a paper on 'The Breeding-habits of *Protopterus*, *Gymnarchus*, and some other West-African Fishes,' in which an account was given of a collecting-trip made during last summer to the swamps of the Gambia river in search of the eggs of *Polypterus*. The eggs of *Polypterus* were not discovered, though a very young specimen measuring only one inch and a quarter in length was found. In this small specimen the dermal bones were not developed, and the external gills were of very great size, the base of the shaft being situated immediately behind the spiracle. The dorsal finlets formed a continuous dorsal fin. The secretary read an extract from a letter which had been addressed to the Colonial Office by the West India Committee, concerning the proposed introduction of the English Starling or the Indian Mynah into St. Kitts, West Indies, to check the increase of grasshoppers, which were causing great damage to the growing crops of that island.

UNIVERSITY AND EDUCATIONAL NEWS.

At the convocation exercises of the University of Chicago on December 18th President Harper announced that Mr. John D. Rockefeller had made a further gift of $1,500,000 to the institution. Of this sum $1,000,000 is to be used as an endowment fund. The balance of the gift is to be used for general needs. Mr. Rockefeller suggests that $100,000 be used for the construction of a university press building. Mr. Leon Mandel has given $25,000 to the university in addition to his previous gifts.

It is said that Brown University has received gifts of $25,000 and $10,000 towards the second million dollars for the university endowment.

An anonymous friend of the University of Pennsylvania has given a fund for prizes in the School of Biology and in the department of interior decoration in the School of Architecture. The annual value of the prizes will be $400 in the School of Biology and $150 in the School of Architecture.

We are glad to learn that the validity of the will of the late Colonel Joseph M. Bennett, of Philadelphia, making a large bequest to the University of Pennsylvania has been sustained, the Court refusing to send the case for trial by jury.

At the annual meeting of trustees of the University of Illinois, at Champaign, the board decided to ask a total appropriation of $900,000 from the Legislature, $90,000 of which is to be used to build a new workshop in place of the one destroyed by fire; $150,000 for the chemical building and $100,000 for a women's dormitory. The remainder will be used for current expenses for the next two years, including $15,000 a year for the library, and $16,000 a year for the establishment of a School of Social and Political Science.

Lord Strathcona was installed as Lord Rector of Aberdeen University on December 18th. At the close of his address he announced that he would give £25,000, provided £50,000 more was raised within a year, to wipe out the debt of the university. Charles Mitchell, of Newcastle, has offered to subscribe £20,000.

Herr H. Huber has bequeathed 50,000 fr. to the Polytechnic Institute at Zurich to be used for scientific excursions.

The Executive Committee of the Board of Trustees of Cornell University has awarded the contract for the use of the medical department on the campus at Ithaca. The building will cost $125,000 and will be ready for use in the autumn of 1902.

At a stated meeting of the Board of Trustees of the University of Pennsylvania, held December 4th, Dr. Edgar F. Smith, professor of chemistry, who has been acting vice-provost for some time, was elected vice-provost. Charles Hugh Shaw, Ph.D. (Penna., 1900), professor of biology in the Temple College, Philadelphia, was elected to an honorary fellowship in botany, in order that he may continue the research work in cytology which he had undertaken while pursuing his graduate work.

President Butler, of Colby University, has resigned and will accept a chair at the University of Chicago.

Attention was called in the last issue of Science to the fact that Professor T. S. Townsend, of Trinity College, Dublin, and Cambridge University, had been appointed to the newly-established Wykeham professorship at Oxford. The abilities of Mr. Townsend are fully recognized, and it is expected that he will place the teaching of electricity on a satisfactory footing at Oxford, yet some dissatisfaction is expressed that an Oxford man should not have been elected. Oxford scientific men get professorships elsewhere, but to judge from the list of professors, they are without honor in their own country. This is thought to be a discouragement to science at Oxford. In the present case, however, the complainants can scarcely point to an Oxford electrician suitable for the post.

At a meeting of the Royal Institution on December 3d, it was announced that Dr. Allan Macfadyen had been elected Fullerian professor of physiology.

Dr. Josef Hort has, owing to ill health, retired from his professorship in the Technical Institute at Karlsruhe.

SCIENCE

NEW SERIES.
VOL. XII. No. 313.

FRIDAY, DECEMBER 28, 1900.

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $5.00.